

AMD R9 290X
Flagship GPU brings the pain and a bunch of new features for gamers. PG. 40



COOLER MASTER V8 GTS
This air cooler is pimpin', but how does it perform? PG. 80



UNUSUAL CASES
Three enclosures that will turn your PC into a conversation piece! PG. 52

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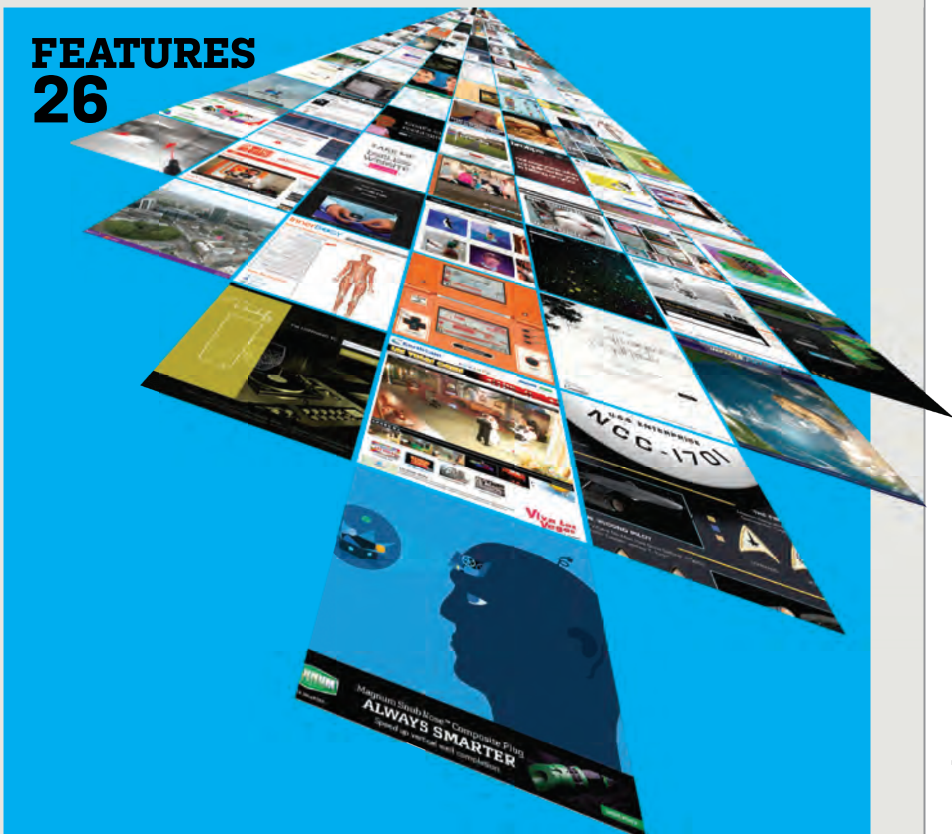
Encrypt your data and keep it safe from prying eyes! PG. 66

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HOLIDAY 2013



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Illustration by Georg Zumbulev



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Gordon Mah Ung

MOVING ON UP, TO THE EAST SIDE

IT'S WITH A heavy heart that I must announce that I am moving on to greener pastures. It's been a good long run at *Maximum PC*, but I have applied for and accepted a new position as chief executive officer of Microsoft. The opening popped up on "jobs you may be interested in" on LinkedIn and, well, I sent in my resume and have received a form email of acceptance, so I must have the job!

Among my first moves as CEO of Microsoft, I will use the power of the bully pulpit to direct all divisions within the company to remember who brung them to the dance: the PC. Yes, Xbox division, we know you bring home a lot of bacon (some of it cooked directly on sizzling PowerPC chips), but you don't have to be possessive about the living room, do you? Surely you can see that our turf battle is letting our neighbors at Valve wedge a PC-powered foot into that territory with the *shudder* Linux-based SteamOS. We really don't want Valve wedging that foot anywhere else, do we? If a Windows-powered console running proper PC hardware designed in this century had been in place years ago, we wouldn't be having this *It's a Wonderful Life* moment. Instead, Gabe Newall would be running down the streets of Bedford Falls screaming "Merry Christmas" at buildings.

While I'm at it, let's also remember that PC gaming and PC enthusiasts have been carrying a lot of the water lately for Microsoft. So, Order 66 will direct all available resources toward making DirectX 12 the most efficient, closer-to-the-metal API available for the PC. Yes, you thought that DirectX 12 was dead, but after receiving a classified briefing from Microsoft's Skunk Works department (which I'm formally declassifying) and with my new power as CEO, I'm declassifying DirectX 12 and giving it the green light. There's just no reason to have another API war with AMD's Mantle—especially when that might benefit Sony or Linux. While we're here, let's also declare a truce with Valve and all of the game publishers to let them know Microsoft is the place to be for gaming and we'll never make it a walled prison like other companies might.

Wow, this executiving is hard. Since I'm here, I will also approve an updated IntelliMouse 3.0. In fact, dig up the old molds and just re-create the original. Call it a replica and charge $150 for it, too. There's no reason to update it with new sensors; just make the same mouse, because the mouse pads on mine are all worn out.

Let me also wield supreme executive power and order the Start button to actually Start something. I propose the standard classic Start Menu when in desktop mode; but when the screen is folded back and you want Metro mode, you double-click the Start Menu to launch the touch-centric interface. And yes, I said Metro. Let Metro AG sue us if it has the balls. This is an OS, not a blasted Walmart, and people know that. And while you're at it, tell legal to get their butts to work on SkyDrive. How anyone can confuse a British media network with cloud-based storage, I don't know.

Also, call up the PC OEMs and tell them to stop with the Chromebooks. We were really just kidding making our own PCs.



Gordon Mah Ung is Maximum PC's deputy editor, senior hardware expert, and all-around muckraker.

submit your questions to: comments@maximumpc.com

THE NEWS

Origin PC Dumps AMD Graphics

Cites poor sales, poor support, and lack of interest from its customers

JUST ONE WEEK after the unveiling of AMD's hot, new GPU lineup (see the full story on page 40), the reaction from one high-end PC vendor wasn't exactly what we expected: Origin PC publicly announced that it would not carry AMD's new cards and would, in fact, dump *all* AMD graphics cards, in favor of using only Nvidia cards.

"Today, Origin PC is removing all AMD GPUs from our offerings on our website. This decision was based on a combination of many factors, including customer experiences, GPU performance/drivers/stability, and requests from our support staff," said Kevin Wasielewski, CEO of the Miami, FL–based company. "Based on our 15-plus years of experience building and selling award-winning high-performance PCs, we strongly feel the best PC gaming experience is on Nvidia GPUs."



As of now, you won't be able to find AMD graphics cards in Origin PC's systems.

With the news appearing perfectly timed to spoil AMD's announcement of its Hawaii-generation video cards, speculation immediately swirled that Nvidia had goaded or outright paid off the company to publicly break from AMD.

Nvidia officials refused to address the rumors but did reiterate to *Maximum PC* what it has said since the beginning: that it had "absolutely not" paid off or influenced Origin PC to ditch its competition.

Origin PC reps also insist the move had nothing to do with any payola, and was only due to a long laundry list of issues the company has had with AMD, including: lack of support, lackluster drivers, inability to secure parts to validate for stability and performance, a higher failure rate than Nvidia graphics cards, and lack of customer demand for them. Origin PC was further miffed to not even receive a courtesy notice from AMD that it was releasing new cards, let alone an invitation to the release event in Hawaii. Instead, according to Origin PC, AMD told them to watch the livestream with everyone else, instead of sharing advance information. Origin PC told us that its own support staff independently made a request to dump AMD, claiming that its video cards create more support calls. The company said it has dropped some motherboard vendors in the past for creating support or quality-control issues, so it's not a new thing. Origin PC says it will continue to carry AMD CPUs, which it doesn't have issues with. And it wouldn't rule out carrying AMD GPUs in the future, either.

AMD declined to comment on the alleged problems, but it did send us links to competitors of Origin PC, where people are already lining up for the new R9 cards in systems.

What's the truth in all this? That's difficult to discern.

Analyst Jon Peddie said he doesn't see any upside to Nvidia even getting involved in this and wonders if it's more about getting in the news.

"Origin isn't that big of an OEM to make Nvidia do anything extraordinary. AMD's business with Origin has been declining," Peddie said. "I can't imagine why Origin even made the announcement. Sure, it got their name in the papers, and you're going to write a story about it. Is that it, just a PR stunt?"

Competitors of Origin PC that *Maximum PC* spoke with were also confused as to why the break was so public. Some thought the move was a bold one that they wished they could make, while others thought it was simply a bad business decision. **–Gordon Mah Ung**

Nvidia Announces G-Sync Monitor Tech



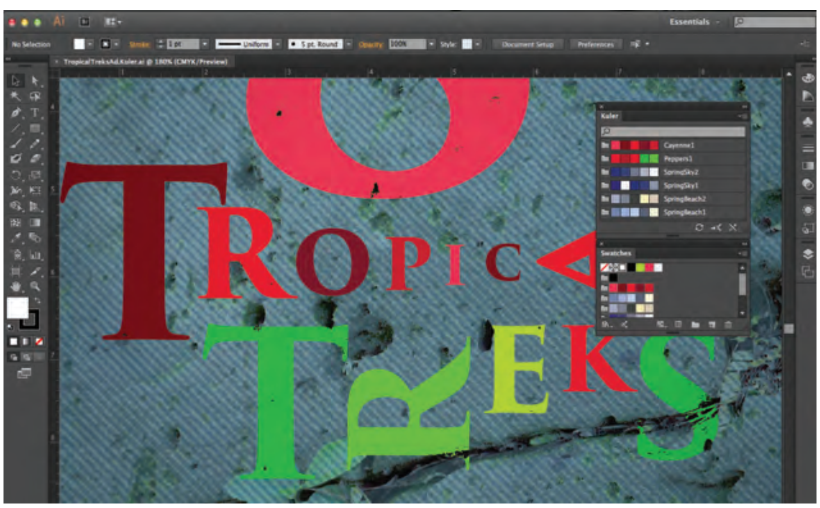
Nvidia announced a new monitor display technology called "G-Sync" at a press event in late October. This module, installed at the monitor factory, synchronizes with Nvidia's Kepler cards (ranging from the GeForce GTX 650 to the GTX 770) to address screen tearing and stutter. Unlike V-sync, which locks your screen to increments of 30 frames per second, G-sync dynamically adjusts refresh rate so that you will always see exactly the frame rate being produced by the GPU, up to 144 fps. Major vendors such as Asus and ViewSonic have already signed up for the deal, and Nvidia had the tech working at the event. They expect availability in Q1 2014, and claim that these monitors will not be much more expensive than normal. **–TM**

PS4 Gamepad Officially PC-Compatible

Shuhei Yoshida, president of Worldwide Studios at Sony, announced in October via Twitter that the PlayStation 4 gamepad will be recognized by Windows without requiring any third-party software or hacks. PS3 controllers need such software, while Xbox 360 controllers are recognized out-of-the-box (though Microsoft's wireless controllers require a PC-specific receiver plugged into a USB port). Microsoft disclosed earlier that its Xbox One gamepad would not have Windows compatibility until 2014. The PS4 controller's gyroscope and touchpad will not work by default, but all the buttons and sticks will. This does not come as a shock, since the PlayStation 4's hardware is very similar to that of a desktop PC, down to the x86 CPU from AMD. **–BK**

Adobe Hacked, Source Code Accessed

Content-creation software publisher Adobe disclosed in October that someone hacked into its customer data and product source code. The hack affected 2.9 million customers, with "names, encrypted credit or debit card numbers, [and] expiration dates" taken. Customers are advised to change their account passwords, and to change the login info for other online accounts that use those same credentials. Those whose credit card info had been accessed were given "additional information on steps you can take to help protect yourself against potential misuse of personal information." In a separate statement, the company's chief security officer, Brad Arkin, mentioned that the source code for Adobe Acrobat, ColdFusion, ColdFusion Builder, and other Adobe products was accessed by "an unauthorized third party." **–BK**





Tom Halfhill
Fast Forward

SMALL IS THE NEXT BIG THING

SOME SAY the next big thing is the "Internet of Things"—zillions of networked devices like smart watches, smart sensors, even smart clothing. A better name might be the Internet of Small Things, because we've always had an Internet of Big Things. Indeed, some of the new small things are just smaller versions of big things.

Which is why Intel recently introduced Quark, its smallest x86 processor core. As the subatomic name implies, it's smaller than Atom, which now becomes the midsize model. Quark is 20 percent the size of an Atom core and sips only 10 percent as much power. Fabricated in Intel's 22nm FinFET technology, it would use less than 25 milliwatts. Only one watt for 40 cores!

A few years ago, Intel swore some industry analysts to secrecy, disclosed this project, and requested our feedback. My first suggestion was to keep the core small by using a subset of the x86 architecture, even if it prevented the core from running the latest software. This advice was controversial, but I didn't think a fully compatible core would be small enough.

My second suggestion was to make it synthesizable. So-called "soft" cores are software models that can generate circuit layouts. Although they are less efficient than custom circuits, they are easier to integrate in chip designs and can be manufactured at any chip foundry. Finally, I urged Intel to license the core to other companies.

Intel heeded two-thirds of my advice. Quark reverts to the original Pentium architecture from 1993, dropping support for extensions like SSE, and is synthesizable. So far, though, it's not licensable. Intel will collaborate with other companies but won't give them full control over design and manufacturing.

Oh, well, two out of three ain't bad. And I think Intel will eventually license Quark—though probably with some entanglements.

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report*.



Thomas McDonald
Game Theory

THE STORY AMONG US

IT TOOK ME a while to warm to Telltale Games's The Walking Dead, an entire game series built around two of my least-favorite mechanics: quick-time events and dialog trees. Yippee. Pass the digital Ambien.

What eventually brought me around, and prepared me for an even better use of the system in The Wolf Among Us, was a change in thinking. A lot us make pleasing noises about narrative and character elements in gaming, but the truth is that gameplay comes first. The *telos* (purpose, or end) of a game is the play. The narrative is what gives the play resonance and depth, and forms the binding element, but the key thing is what you *do*.

Telltale's latest work inverts that, finding a way to place the narrative first, while making the gameplay merely a driving element. All of the screen-scanning, gathering, talking, and fighting work are just fine, as long as they stay out of the way. Make it more complex, and the narrative stalls. Place it in a game with poor writing and no cinematic sensibility, and the gameplay is merely laughable.

But place it at the service of storytelling skill that is equal to the best we're seeing on television these days, and it works like a dream.

Television is the most appropriate analog, particularly as it's grown more sophisticated in the post-*Sopranos*, post-*Lost*, *Breaking Bad* era. Television's embrace of serial storytelling—lavish plotlines, deep characters, and serious world-building spread out over dozens of hours—is giving the medium new heft.

The Wolf Among Us nails this sweet spot, creating a noir mystery light on action and heavy on character, atmosphere, and story, then ending with that most tantalizing tease: "Next time on…."

We're seeing the flowering of something great here: a game you return to once a month or once a week for a new two-hour installment. As TV matures in its mastery of this serial format, so will games, and at some point, the two will merge into new forms of mainstream entertainment.

Thomas L. McDonald is Editor-at-Large of Games Magazine.

Nvidia Invests $5M in Two Ubisoft Games

Hardware maker Nvidia announced in early October that it was injecting $5 million into game publisher Ubisoft's development of Assassin's Creed IV and Watch Dogs. Nvidia has already demoed AC4 (pictured below) with high-resolution textures and promises "PC-exclusive effects and features" for both games, which were also slated for release on current and upcoming consoles in November. Interestingly, 12 days after this announcement, Ubisoft announced that Watch Dogs would be delayed until next spring, although neither party acknowledged a connection between the two events. Ubisoft said, "We needed to take the extra time to polish and fine tune every detail." **–BK**



100Gb/s Wireless Connections Achieved

Imagine for a moment being able to transfer the entire contents of a Blu-ray disc or five DVDs over a wireless connection in a mere two seconds. Impossible, you say? For Professor Ingmar Kallffass of Stuttgart University and his fellow researchers, ludicrous speed is not so crazy after all. Publishing in the October issue of *Nature Photonics*, the researches outline a method for transmitting data wirelessly at a head-snapping 100 gigabits per second. They set a new world record, though the distance was a modest 20 meters, in laboratory conditions. Previous experiments topped out at 40Gb/s over 1 kilometer. Kallffass characterized the tech as "an inexpensive and flexible alternative to optical fiber networks" especially suited for broadband access in rural areas. **–PL**

Tech Tragedies and Triumphs

A monthly snapshot of what's up and down in tech

TRIUMPHS

VALVE
Announces SteamOS, Steam Box, and an all-new controller that pits Valve against Sony and Microsoft for control of the living room.

INTEL
Rowdy chip maker defies Wall Street's expectations with surprisingly high Q3 profits.

GAMERS
With new hardware on the way from AMD and Nvidia, plus SteamOS and next-gen consoles coming soon, it's truly a golden age of gaming.

TRAGEDIES

INTEL
Announced a one-quarter delay of its 14nm Broadwell chips due to yield issues. It really "ticks" us off.

GOOGLE
Announces it will start using customer names and photos for online reviews, prompting users to use Eric Schmidt as their avatar photo.

ADOBE
Has its servers hacked, loses data for 2.9 million customers as well as source code for software. This is about as bad as it gets.

Quinn Norton
Byte Rights

BRING BACK OLD-SKOOL DECENTRALIZING

IT'S CRAZY TO think of how this whole Internet age got started. Instead of networking as we know it, you asked a guy named Jon Postel for an address. If you wanted email, you ran a mail server. Angry Birds looked terrible on the PDP-11, but at least it was two-player.

In those days, you couldn't buy services or watch ads in exchange for access. What that meant was the 'net was social, cooperative, and decentralized. If you wanted to put up ill-thought-out drunken selfies, you had to put up a server to host them, usually with the help of your local geek. It was more work, but it meant you controlled your data. Not Google, Facebook, or the NSA.

The Paleonet was a strange place, but it was something we built together. It was a place without click-through agreements or our lives being tracked and tallied in the databases of marketers and governments.

It's time to get that back. Between copyright insanity, contracts that turn everyone into felons, and massive spying on service providers, it's time to give up on centralized services and start looking to each other.

There is nothing—not a thing—we host elsewhere on the net that we couldn't provide to each other through community server sharing. It's how we all did it before we lost our privacy. It's the only way to get control of our online existence back. It means going in with friends or neighbors on a server account somewhere, downloading software, and learning to run what you use.

I've been doing this for 15 years. It's great, knowing that we're a group of friends helping each other. I doubt my buddy M is spying on me on behalf of my government, or Nike. Not so sure about Facebook.

Quinn Norton writes about copyright for Wired News and other publications.

Valve Announces SteamOS, Machines, and Controller

Cave-dwellers may be surprised to learn that game developer and Steam owner Valve Software made three big announcements at the end of September, spaced across several days. We had our fingers crossed that one of them would be Half-Life 3, but Valve had other things in mind: namely, SteamOS, Steam Machines, and the Steam Controller gamepad. None of these are ready for store shelves just yet, and we haven't gotten any behind-the-scenes access, but there are some bullet points that you should know.

First, SteamOS. This Linux distro will let you stream a game across a local network from, say, a Windows PC. This allows you access to your entire Steam library, regardless of what operating system the game is written for. And since the streaming box is just a middle-man, it doesn't even need to have fancy gaming hardware.

Second, Steam Machines. These will consist of three tiers of pre-built systems with SteamOS pre-installed. The 300 test-market units Valve plans to release will use Nvidia video cards and Intel CPUs, but AMD will be fully compatible. SteamOS will also be available separately (and presumably at no cost)—you don't need to buy a Steam Machine to get it.

Lastly, the Steam Controller. In a nutshell, it's a wireless-only gamepad with no thumbsticks. Instead, it uses two clickable, touch-sensitive pads with high-precision vibration feedback, and a small touchscreen in the center. It's not known yet if it uses rechargeable batteries or a pack, or what method is used to recharge it. Valve released a YouTube video of the device in action: http://bit.ly/15ZjQBD. **–TM**



BitTorrent Releases Encrypted Chat Client

File-sharing software developer BitTorrent Labs released a "private alpha" of a messaging client simply labeled BitTorrent Chat. Of interest is its default encryption and peer-to-peer data transmission, both of which help to avoid middle-men who could intercept and read the communication. It comes at a time when concerns about the security of our data and personal information is arguably at an all-time high. Besides these details, however, the company has not said much about how the program operates. No release date or price has been announced, but based on BitTorrent's previous efforts, we expect the software to be free. Curious experimenters can sign up on the website: http://bit.ly/18n4rsD. **–TM**

Stacked 160GB/s RAM Modules Start Shipping

Computer memory manufacturer Micron announced in late September that it has begun shipping engineering samples of its "hybrid memory cube" random access memory to early adopters. This type of RAM tops out at a staggering 160GB/s. By comparison, a stick of 1,600MHz DDR3 hits a ceiling of "just" 12.8GB/s. Micron expects to be able to reach a storage capacity of 4GB by early next year, and theoretical speeds of up to 320GB/s. According to tech website ExtremeTech, this would reach the performance level of an Intel CPU's Level 3 cache, only with orders of magnitude more capacity. Part of the speed comes from stacking memory and an on-chip controller. **–TM**

THE LIST

8 PRODUCTS THAT WERE AHEAD OF THEIR TIME



8 DELL STREAK

The world laughed at this phone/tablet Frankenphone in 2010, but it was actually the first phablet.

7 RIO PMP 300

The original MP3 player, it was around for three years before the iPod stole the spotlight.





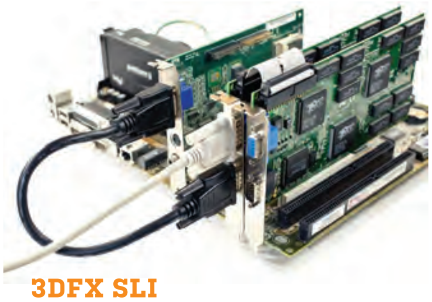
6 HP COMPAQ TC1000

Microsoft showed off a tablet PC prototype back in 2000, but it never caught on.

5 NOKIA COMMUNICATOR 9000

Hailed as the world's first smartphone, this techno-brick surfaced in 1996 with a 24MHz CPU.





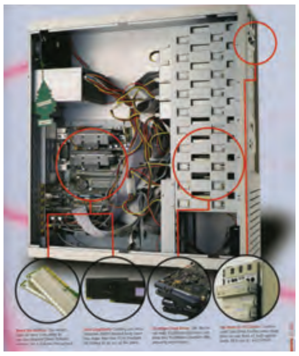
4 3DFX SLI

3dfx introduced the world to Scan-Line Interleave in 1998, paving the road for SLI and CrossFire.

3 SOLID STATE DRIVES

The first desktop SSDs were big, slow, and expensive. Now, we can't imagine life without them.





2 SUPER TOWER CASES

Dream Machine 2000 featured a massive desktop chassis—looks like we were ahead of the curve, again.

1 VIRTUAL BOY

In 1995, the Virtual Boy promised true 3D graphics. Hopefully, Oculus Rift will succeed where the VB failed.



HEAD TO HEAD

BY DAVID MURPHY

Windows 8 vs. Windows 8.1

You are your own worst enemy, indeed. In this month's matchup, we pit Windows 8.1 against its predecessor, Windows 8, in not so much an outright battle, but a comparison of some of the more notable tweaks that Microsoft has slapped into its first refresh of the controversial operating system. Just make sure you tell your system to stop hitting itself, OK?



Do you like clutter? Then you must be loving Windows 8 right about now; the Start Screen can be a power user's worst enemy.

ROUND 1

Start Menu

We'll begrudgingly give Windows 8.1 the win here, but that's not to say we agree with the way Microsoft went about changing Windows 8's access to applications. The now-included Start button within Windows 8.1's desktop mode is hardly a Start button in the normal, Windows 7-or-older sense of the phrase. Rather, it takes one back to the standard ol' Start Screen much as if you accidentally poked the Windows key on your keyboard. No fair.

We do, however, appreciate some of the subtle modifications made to this Start Screen. It includes a more direct shortcut to one's (newly filter-friendly) All Apps menu, as well as a more strict interpretation of just what gets dumped onto your Start Screen when you install an app. With Windows 8, slapping the Combined Community Codec Pack, for instance, littered our Start Screen with shortcuts. On Windows 8.1, zilch; you only get the tile dump if you go All Apps.

Winner: Windows 8.1

ROUND 2

User Customization

Windows 8.1 takes the cake in this category, if for nothing else than its newfound ability to allow users to boot directly to the desktop upon Windows' startup. However, Microsoft has also kicked up Windows 8's Snap View feature in this update, freeing you from the confines of only being able to view two apps at once within Modern.

We also like that you can now have Windows 8.1 jump to the Start Screen *or* the Apps view when you tap the Start button. It's a simple tweak that gives power users access to everything if they want it, and users who prefer a more simplified Start Screen far less of a headache.

Those looking to build a little more unity between their desktop and Start Screen can now elect to use a matching background for both. The OS also comes with a host of new options for background patterns and images.

Winner: Windows 8.1

HEAD

Windows 8.1 gives you a flood of tiles, but only if you want it; otherwise, your Start Screen is far less headache-inducing after you've installed a few apps.



ROUND 3

App Store

It ain't perfect by any means—sorry, Windows users: Google and Apple beat your built-in offering by a country mile—but we do appreciate the improvements found within Windows 8.1's official app store. You're still stuck with horizontal scrolling, unfortunately, but at least Microsoft is attempting to make it a little easier for users to find apps they might want to install and play with.

Case in point: The store now features a lovely "Trending" section right on its front page that should, ideally, show you which apps users find most interesting. The same goes for its brand-new (and aptly titled) "New & Rising" section, as well as the easily accessible lists of Top Paid and Top Free apps.

We also find ourselves loving the integration of the right-click App Bar that pulls up easily accessible (or finger-tap-able) categories of apps in addition to a list of that which you've already installed. That said, this is still a fairly lame-o app store.

Winner: Windows 8.1

ROUND 4

Search

We're torn. What should real search functionality be within an operating system? Just something that searches for files and data throughout your hard drives? A hybridized, Windows 8–like approach that allows you to search for specific apps, search within settings on your desktop, and even search within the apps themselves?

Microsoft seems to still be unsure what you should receive when you start typing random letters on Windows 8.1's Start Screen. In Windows 8.1, search now integrates a Bing-based web search for whatever it is you're typing on the Start Screen in addition to a search of anything on your system. That's the default "Everything" view, which you can isolate to Settings, Files, Web Images, and Videos via a provided filter.

If you're looking to search within apps—like, say, your email—you have to pull up the app itself to do so. We shrug.

Winner: Tie

ROUND 5

SkyDrive

Windows 8.1 packs a ton of additional SkyDrive functionality into the operating system by default, making it more of a useful companion than a semi-hidden afterthought.

Take, for example, the simple fact that you can now see exactly how much SkyDrive storage you're using (and have remaining) within the new SkyDrive settings menu in Modern's PC Settings area. (And, of course, you can also quickly purchase more.)

Flip on SkyDrive, and you'll also be given the option to save your documents to the cloud by default instead of your local hard drive—a pleasant little way to ensure you're always cloud-connected. Windows 8.1 comes with additional settings that you can back up or synchronize to the cloud, and SkyDrive now integrates wonderfully within File Explorer itself. Simply put, you can access your SkyDrive files (if online) without having to synchronize them, and you can select files or folders to "Make Offline" as you see fit.

Winner: Windows 8.1

And the Winner Is...

We're not going to lie; it would be a bit silly to think that an update to a major operating system is ultimately worse than the original version of the OS. Then again, take Microsoft's track record into account—it did take a big service pack to make Windows Vista palatable. While **Windows 8.1** wins the day against Windows 8, keep in mind that there are things about the update that might be a bit jarring; you might not even like them. But, hey, there's always Windows 8.2?

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Driver Overkill
> Sidegrades Everywhere
> Failing Boot Sector

Nuke It from Orbit?

A while back, I was trying to update my graphics card drivers but was unable to update PhysX due to an error I kept receiving about already having the most recent version installed, despite my uninstalling it prior to running the update. After a search around the Internet, I found out that registry entries left behind by my original PhysX install were causing the error. I then read on the web several forum users advocating that whenever one wants to update their GPU drivers, they should go into safe mode, uninstall all of their driver-related programs, manually hunt for and delete remaining files, purge the registry of any references to GPU drivers, run CCleaner, and perform a variety of other tasks to nuke the old GPU drivers from orbit. Since that day I have been only using that method whenever installing new drivers. However, it's come to the point that it takes five to six hours to update my GPU drivers now, and my computer is unusable for that whole time. It's causing me to only update my GPU drivers every six months or so, and I would like to know if it's still necessary to go through all this. Is nuking my old drivers before putting in new ones really worth it? Or should I just update like normal?

—**Sami Saab**

THE DOCTOR RESPONDS: That's a lot of work to go through every time you want to update your drivers. The Doc's advice is to just run the updater as normal, and do the long and annoying method only if something goes wrong with the normal way. Even if it happens one in every 10 times, which seems high, you're saving yourself 60-plus hours over those 10 times. Since you're running Nvidia hardware (PhysX isn't available on AMD) there is another option that's not quite as intensive: When you download the latest driver and install it, select Custom Install and then check Clean Install. The driver install will then remove the previous driver and perform a "clean" install rather than installing on top of the previous version. This increases the install time by a few seconds to a few minutes depending on your system.

Updating your drivers shouldn't take more than about 10 minutes, provided you're not switching GPUs entirely. If you are switching GPUs, and especially if you're going from AMD to Nvidia or vice versa, you should uninstall your old drivers first. But even that shouldn't take five or six hours.



No need for a full nuke; performing a clean installation through the normal driver install method should be good enough, unless you're switching platforms.

Sidegrade Stories

I'm currently sporting a Core i7-2600K with a Gigabyte GA-Z77X-UD5H , 16GB DDR3/1600 RAM, 2GB AMD Radeon HD 6950, and an OCZ Vertex 4 256GB SSD. My system runs nicely with Windows 8 Professional, but I recently upgraded my board to an LGA1155 and am contemplated biting the bullet and picking up an Ivy Bridge Core i7-3770K. If I do this, no matter what, I am going to

↘ submit your questions to: doctor@maximumpc.com

be getting an upgraded video card and new RAM, which means I'm upgrading almost everything anyway. Is it worth upgrading to a Haswell Core i7-4770, in that case, or should I re-use the old board and just upgrade the CPU/ RAM on a dead socket? The question isn't whether I can afford it, but rather what's the best move?

I'm not incredibly impressed with the upgrade paths from Sandy Bridge—it doesn't seem like the improvements justify the means. I'm seeking to replace my second, older rig with my Sandy Bridge parts. The older one is a Core 2 Quad 9650 with 8GB RAM and an 8800 GTS video card. Do you have an opinion on the matter?

—Joe Cava

THE DOCTOR RESPONDS: So, you're getting a new GPU and RAM no matter what you do with the CPU and mobo (although the Doc isn't sure why you need new RAM if you already have 16GB of DDR3/1600). In the Doc's opinion, the smartest move is that GPU upgrade. You're right that there isn't a really satisfying upgrade path from your Sandy Bridge CPU and Ivy Bridge mobo; that 2600K is still more than enough for gaming. The only reason to upgrade the CPU and mobo on your main rig at all is to be able to use the Sandy Bridge parts to upgrade the rig that has the Core 2 Quad. That's a substantial upgrade, and in that case you should move your newer rig to Haswell so you can use the old mobo and CPU in your other machine. Of course, since you're upgrading your RAM and GPU on the new rig, might as well put the old ones in your older rig, too. Which now looks exactly the same as your main rig did before the upgrades. At least you save some money on a case and PSU.

CrossFire 6850 vs. One 7950

I currently have an Eyefinity multi-monitor setup utilizing two Radeon HD 6850s, with 1GB frame buffer each, in CrossFire. The setup works well and I've been very satisfied, but I'm considering upgrading to a single 3GB Radeon HD 7950. Will I see any benefit from this switch? Every benchmark I can find says the CrossFire 6850s are faster for single-screen resolutions, but that you need more than 1GB of RAM for optimum Eyefinity performance. What is the right answer?

—Louis Vitelli

THE DOCTOR RESPONDS: Two 6850s in CrossFire are around the same as, or slightly faster than, a single 7950, but the 7950 uses much less power, it gives you three times the frame buffer, and is free of the micro-stutter that can sometimes accompany multi-GPU setups, as well as the issue of ensuring your games have CrossFire profiles. For a multi-monitor setup, the Doc would go with the single 7950. That said, you're essentially paying $250 for 2GB more frame buffer. If you can squeeze your budget a little further, you should consider a Radeon HD 7970 or 7970 GHz edition, so you get an actual performance increase from your GPU upgrade. They run about $300 and $375, respectively, these days. Of course, AMD has also announced its new R7 and R9 cards, so those worth a gander, too. As we are fond of saying here at *Maximum PC*, your best bet is to get the single-fastest GPU you can afford. And in your case, to make sure it has as much frame buffer as possible, since you're running multiple monitors.

Missing Boot Sector; RAID 0?

One day I came home as normal, started up my computer, and it turned up a black screen, with nothing on it but the words "Missing Operating System." What could have caused this? I have my OS (Windows 7) loaded onto a 120GB SSD. My computer still recognizes the drive, however, it can't find the OS. I doubt it was caused by a virus (I run MSE every time I start my system) and I hadn't downloaded or installed anything recently. The first time this happened, I shut down and disconnected/ reconnected the drive, and it worked. But that only worked once. I tried it again the next day, and I couldn't get it to start. I have no idea what could be wrong.

I was going to boot the installation disc, and run the "Repair my computer" option. Would this work, and save my data? I don't have much important data on my SSD, (most is on my HDD) but I still don't want to lose it.

Also, I'm running out of room on my SSD, so I bought an identical SSD to RAID 0 with my current one. However, I did not realize how much trouble it is to move an OS between drives. What do you think is the best way to RAID 0 my SSDs while still keeping my OS the way it is?

—Jackson Gray

THE DOCTOR RESPONDS: Take the path of the least resistance. First, disconnect any external USB storage devices you have—USB keys, USB hard drives—any external devices that may have confused the boot. If that doesn't work, go into the UEFI/BIOS and check the boot order to make sure it hasn't changed. The Doc has seen motherboards that lost track of the boot drive because a USB drive was inserted. After that, running the "Repair my computer" option from the installation disc is a good next step; if you have a problem with your boot sector, that'll identify it and hopefully fix it. If not, it could be a problem with your SATA connection. Try replacing the cable with a different one. Finally, the worst-case scenario is a failure of the SSD itself. SSDs are resistant to vibration and shock but their long-term reliability is proving to be the same as a hard drive. Many people make the mistake of believing that SSDs are infallible and forego backups. Oftentimes, the actual controller on the SSD will fail. Data can be recovered but it's usually left to professional data-recovery services. Let's hope it's not that and you can see the drive. If you can't repair the boot sector using Windows' "repair" option, try booting your computer from a live CD to see if the drive itself shows up. If so, copy as much of the data off of it as you can.

As for running out of room, you're probably better off skipping the RAID and just adding the new SSD to your computer as a separate drive, especially if you're having problems with your first one. To get your current image onto your RAID, you'd have to write an image of your whole disk, including boot sectors and hidden partitions, to an external drive, set up the RAID, and write that image back to the RAIDed drives. Keep in mind that any problems with either of the drives renders your whole RAID a bust, so the Doc suggests you cut your losses and just add the second SSD as a separate volume, at least until you pin down the problem with your first SSD.

E Is for Egregious

After waiting patiently to replace my 2-year-old Sandy Bridge-E Core i7-3820 CPU with the Ivy Bridge-E Core i7-4820K, I've just learned that Intel has no plans to provide a BIOS update for my DX79SR Extreme Edition

motherboard, so the Core i7-4820K will never work in the board's LGA2011 socket. This really hurts, especially since Asus and Gigabyte are taking care of their customers. I know Intel is getting out of the mobo market, but I wish the company would do the right thing and update the BIOS. If it won't, are there third-party vendors that might do this? I'd love to upgrade the CPU and then hang onto my box for a couple more years.

—Tom

THE DOCTOR RESPONDS: You're right, Tom. You've been officially burned big time by Intel. The Doc asked Intel why it has put its DX79SR in a life raft and set it adrift with two gallons of water and a tin of Pringles. The official answer? We never promised you a rose garden. Intel says it never committed to upgrade support for the Ivy Bridge-E processors in it X79 boards so it's not breaking any promises. The real answer, of course, is that there's literally no one left to update the BIOS. With Intel spooling-down the board division, the people who could have done it have quit, been transferred, or laid off, so it's unlikely to happen unless enough X79SR users cry foul that it turns into a bad publicity problem for the company. The good news is that it's pretty tough to justify going from a Core i7-3820 to a Core i7-4820K. You'll probably see a 10 to 15 percent boost in performance. That's decent, but really not worth the upgrade. It makes far more sense to move to a six-core Ivy Bridge-E part (assuming your apps need the cores and threads) or to just stay with the Core i7-3820 and put the money into a bigger and faster SSD, more RAM, or a big fat GPU. This is the month of The Doctor telling everyone not to sidegrade, apparently.

Displays Won't Display Right

I have two displays: a 2012 HP 2711x at 1920x1080, and an older ViewSonic at 1280x1024. I recently put the two together, but number one has decided to letterbox itself so that 1080p becomes 1000p. It may not seem like much, but the monitor itself already has a one-inch bezel around it. Add the letterboxing, and you have a grand total of 2.3 inches of bezel, which is extremely annoying.
I have tried adjusting the Windows display properties, fiddled with the monitor settings, and even installed DisplayFusion, which you've recommended. My power-user instinct tells me that this is fixable. I am running a Dell Inspiron 620S (so mainstream, I know) with an AMD 6 450 GPU. Is this case curable, Doctor?

—Will Dang

THE DOCTOR RESPONDS: You should definitely be able to run each of those monitors at its respective native resolution with that video card. The Radeon HD 6450 has HDMI, DisplayPort, VGA, and DVI outputs, and the HP 2711x has DVI-D, HDMI, and VGA inputs, and all of those are capable of running at 1920x1080. You didn't mention whether you were using Windows native display drivers or the latest version of AMD's Catalyst, which you can download from AMD.com. Once you have the latest version, try setting your monitor resolution from within Catalyst Control Center, rather than Windows' settings or DisplayFusion.

8 or Wait?

I read that one of the *Maximum PC* staff has now switched to Win8. I have been hesitant to do so, mostly because some of my current software programs may not run well, according to info I've read on user forums.

But I hear Win8 is faster and better than Win7. Is it? In what ways and by how much? What common programs and hardware are most likely to have issues with Win8 to the point that it's not worth adopting yet? What percent of *Maximum PC* staff has converted to 8?

—Doug S.

THE DOCTOR RESPONDS: As we noted in our review (http://bit.ly/PCitPe), "Windows 8 performance is generally the same as Windows 7, with a performance edge in anything that uses the Windows Media Foundation and likely anything that is heavily multithreaded. USB 3.0 is also markedly improved." You can see a more detailed explanation in the link above. Because Win8 is built on the same code base as Win7, nearly all hardware and software that works in Win7 should work in Win8. We haven't seen too many instances where something suddenly stopped working in Win8, but if there are specific programs and hardware you rely on, you should check the manufacturer's website before upgrading.

As for the *Maximum PC* staff, they're split down the middle. Three editors use Win7, and three use Win8, although two of those use Classic Shell (www.classicshell.net) to bring back the Start Menu. That seems like cheating, but you get the desktop performance improvements without having to deal with the Modern UI.

57 Sites to Visit When You're Bored



A collection of online time killers

BY THE MAXIMUM PC STAFF AND PAUL LILLY

BEFORE THE INTERNET came into its own, finding something to do to cure boredom was a task in and of itself. At work, you could count the holes in the ceiling, crumple pieces of paper and practice your cubicle hook shot, or get lost in a game of Minesweeper, all the while hoping your boss wouldn't wander by.

We have it much easier these days. The Internet isn't just fleshed out, it's flooded with more websites than you'll ever have time to visit. Many of them suck, of course, and several others will leave you with an infection quicker than a one night stand in the red-light district, but there are also a vast number of gems buried beneath all the rubble.

Get ready to add some bookmarks to your browser because we've gone and gathered 57 websites guaranteed to help you kill time when the day just seems to drag on.


TAKE ME TO A USELESS WEBSITE
PLEASE
Coin Tricks
The Coin Fold
InnerBODY
Select a Human Anatomy System Below to Begin:
Share this resource!
brotips
not everyone who compliments you is hitting on you.
DUDE... FIREFLIES ARE LIKE NATURE'S LASER POINTERS
Goat's eye rectangular
Top Documentary
Drinkify
I'M LISTENING TO
GAME & WATCH
CONTROLLER
Nintendo
JUMP
EarthCam
LAS VEGAS CAMS
Viva Las Vegas
Google
U.S.S. ENTERPRISE
NCC-1701
THE SECOND PILOT
"Where No Man Has Gone Before" (1966)
COMMAND
IMPACT: EARTH!
A Wealth of Knowledge
Magnum Snub Nose™ Composite Plug
ALWAYS SMARTER
Speed up vertical well completion.



INNER BODY

THE WONDER WITHIN US ALL How much do you *really* know about your own body? Probably less than you think. Inner Body is your interactive guide to the complex human system and all of its inner workings. Wow your friends by learning everything there is to know about the urinary system!
www.innerbody.com

MAGIC SECRETS EXPLAINED

DISPELLING THE MYSTERY It's been said that a true magician never reveals his secrets, but that's a bunch of hogwash. In fact, if you head over to Magic Secrets Explained, a site that's just what it sounds like, you can learn a bevy of magic tricks from well-known magicians like Criss Angel, David Blaine, and others.
www.secrets-explained.com

DUMB LAWS

KEEPING US SAFE FROM OURSELVES Did you know that in Kansas, it's illegal to shoot rabbits from motorboats? You're also not allowed to use mules to hunt ducks. In Idaho, riding a merry-go-round on Sunday is against the law. Look up all kinds of dumb laws by state!
www.dumblaws.com

WILL IT BLEND

DON'T TRY THIS AT HOME Pretty much anything and everything will blend in a Blendtec blender, but knowing the answer doesn't make the videos on this site any less enjoyable. Watch Blendtec founder Tom Dickson demonstrate his pride and joy shredding things like an iPad, glass marbles, and even Super Glue. We dare you to try and watch just one video.
www.willitblend.com

QUICK MEME

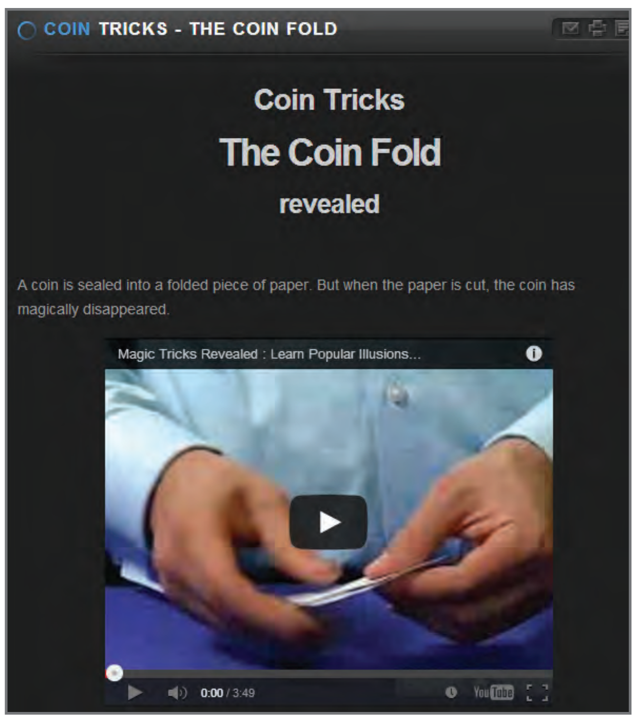
GO VIRAL! Don't let your rapier wit go to waste. Instead, create a hilarious meme and maybe, just maybe, it will go viral. Or it will get lost in the shuffle of the thousands of other memes. Either way, a visit to QuickMeme.com isn't likely to be quick at all.
www.quickmeme.com

YOU SUCK AT PHOTOSHOP

WHAT *NOT* TO DO If you're a Photoshop whiz, you might look at the name of this YouTube series and say, "Them's fightin' words!" For everyone else, the You Suck at Photoshop series is a hilarious way to learn the ins and outs by a very talented narrator who clearly has some personal issues.
http://bit.ly/9Ftp7V

SOMEECARDS

SAY IT WITH SARCASM When you have something sarcastic to say but don't know exactly how to phrase it, Someecards is your go-to site. There's a comical e-card for every occasion, be it a birthday or whatever topical trend is dominating your Facebook feed. Or just visit the site when you need a good laugh!
www.someecards.com



DUCTIVITIES

THE CORNERSTONE OF ADVANCED CIVILIZATION Food, water, oxygen, and Duct Tape—with those four things, you can not only survive any situation, but thrive in it. Why Duct Tape? Well, just head over to Ductivities to see some of the many things you can build with a roll (or dozen) of Duct Tape.
http://bit.ly/13osna5

DIGITAL PUBLIC LIBRARY OF AMERICA

GROW YOUR MELON If you have some time to kill and want to upgrade your internal knowledge bank, the Digital Public Library of America is a great place to start. It has over 2.5 million items from libraries, archives, and museums, and unless you happen to be Ben Stein, it's nigh impossible to spend a few minutes clicking through articles without emerging at least slightly more knowledgeable than when you started.
http://dp.la

THE USELESS WEB

YOU DON'T KNOW WHAT YOU'RE MISSING The Internet is composed of around 4 billion webpages. How many of them are quirky? We're not sure, but The Useless Web will take you to a new one each time you click. You might see a dog licking your LCD screen or Oprah Winfrey seemingly unleashing a horde of bees on a studio audience. They may be useless sites, but they're also amusing.
www.theuselessweb.com



DRINKIFY

MAKE A LIBATION TO MATCH THE MOOD It's Wednesday night and your friends don't want to go out until the weekend, so you purchase a new digital album from Amazon and settle for an evening of _____ (insert your favorite artist or band here). Now all you need is a stiff drink, but what goes best with _____? Drinkify will tell you exactly what you should be pouring down your gullet as you listen to _____.
http://drinkify.org

You Can't Handle the Cute

THERE'S NOTHING WRONG WITH WANTING TO LOOK AT KITTENS, PUPPIES, AND OTHER AWWW-INDUCING PHOTOS. HERE ARE SOME OF OUR FAVORITE RESOURCES.



CUTE OVERLOAD

The site that started it all, CO, as it's known, is the homepage for cute aficionados. It even has a Cats and Racks category.
www.cuteoverload.com



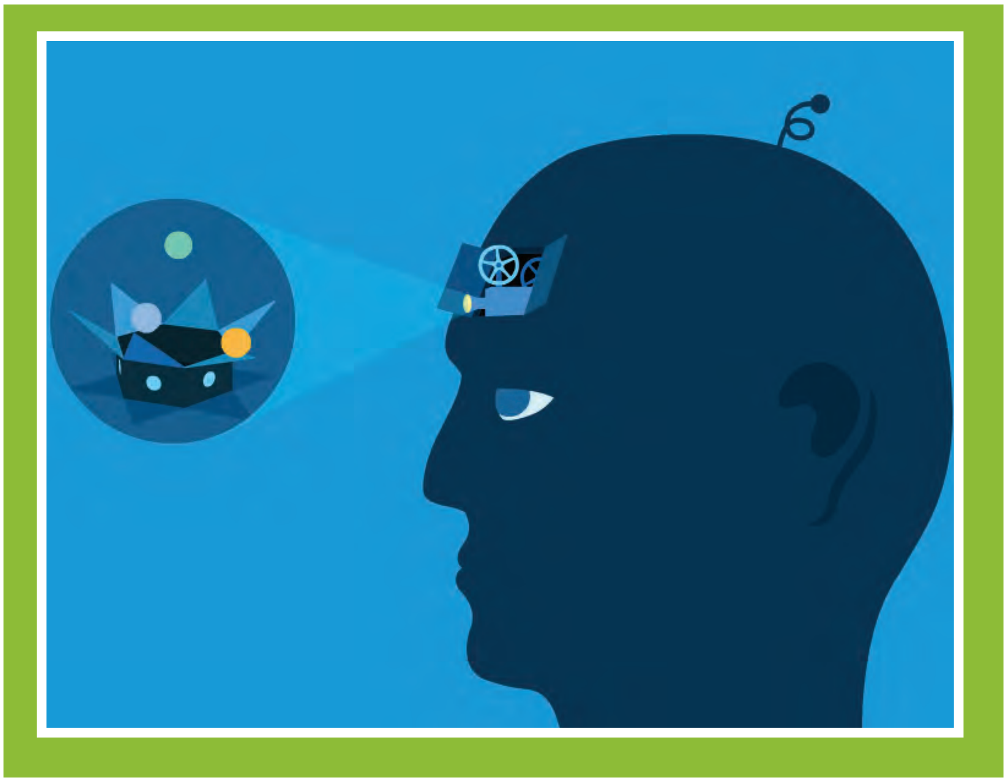
CUTE ROULETTE

Also known as "click and squee," this site shows you one cute thing after another in a never-ending slide show of redonkulessness.
www.cuteroulette.com



LOVE MEOW

This site chronicles the heart-warming stories of shelter cats, rescues, and special-needs kittens and cats. Keep some Kleenex handy.
www.lovemeow.com



CRACK SHACK OR MANSION

CAN YOU TELL THE DIFF? You would think it'd be easy to tell the difference between a crack shack and a mansion. Then again, you can't judge a book by its cover, and apparently we can't tell the difference between a crappy abode and one that costs millions of dollars. Can you? Give it a whirl the next time you're bored.
www.crackshackormansion.com

I WASTE SO MUCH TIME

COMIC JUNK FOOD The Internet's always good for a laugh, and unless your funny bone is broken, you'll find plenty of them on I Waste So Much Time. The premise is simple: You look, you laugh (or don't), and then rate the pictures and videos (optional). When you've killed enough time, you can go on with your daily routine, only in a better mood.
http://iwastesomuchtime.com

FUNNY TYPOS

HELARIOUS If their's one thing *Maximum PC* readers like too do, it's play games. If their's a second thing, its overclocking. And if theres a third, its point out typos. Funny Typos is a sight taylor made for you!
www.funnytypos.com



AWKWARD FAMILY PHOTOS

BOY, DO I FEEL BETTER ABOUT MY UPBRINGING You may think your family is a little bit weird, and maybe it is. But you know what? You're not alone. Far from it, in fact, as Awkward Family Photos proves. Spend a few minutes flipping through pages of pictures of other odd families and you'll come away convinced you're more normal than you thought.
http://awkwardfamilyphotos.com

THE MOST AWKWARDLY PUBLIC BREAK UPS IN FACEBOOK HISTORY

THE NAME SAYS IT ALL Let's face it, breaking up with someone or being broken up with isn't always easy. It's especially bad when it's done on social media, before family and friends. The Most Awkwardly Public Break Ups in Facebook History captures many of these moments, and they're often hilarious to read.
http://some.ly/18qghAY

FEED THE HEAD

A SITE FOR SURREALISTS One of the stranger sites on the web, Feed The Head is deceptively engaging. Getting the head to breathe fire is rather easy, but can you grow a beard? There's a lot to discover here, and when you've exhausted all you can do, click the VectorPark.com link in the upper-left corner for similar time wasters.
www.feedthehead.net

LITERALLY UNBELIEVABLE

PEOPLE WHO DON'T GET PARODY Everybody knows that Onion stories are satirical... well, almost everybody. Literally Unbelievable archives instances on social media where people take Onion stories to be true. You'll laugh and then subsequently cry over how dumb people can be.
http://literallyunbelievable.org



EPIC RAP BATTLES OF HISTORY

RHYMES ABOUT THE WAY IT WAS Who was the better inventor: Thomas Edison or Nikola Tesla? Who's the bigger brainiac: Stephen Hawking or Albert Einstein? Such questions can only be legitimately answered through Epic Rap Battles of History, which has a bunch of nerdy white guys dressing up as history's most famous figures and duking it out with surprisingly clever rhymes. www.epicrapbattlesofhistory.com

F MY LIFE

OK, MAYBE IT'S NOT SO BAD We're all stuck in a rut at points, but if you can't laugh at yourself when you're down, who can you laugh at? That's the thinking behind this website, which collects the most entertaining FML moments on social media. The site will have you crying at the misfortune of others, but it won't be because you're sad. www.fmylife.com

BEST OF CRAIGSLIST

CLASSIFIEDS CAN BE COMEDY GOLD Craigslist can be a great tool when you're trying to sell your used goods or buy items on the cheap, but browsing some of the listings can also be highly entertaining. Enter Craigslist's Best Of section, which highlights some of the zanier, funnier posts, many of which are more satirical than legitimate. www.craigslist.org/about/best/all



Five Must-See Subreddits

REDDIT.COM SELLS ITSELF AS "THE FRONT PAGE OF THE INTERNET." BUT IT'S THE NICHE SUB-COMMUNITIES ("SUBREDDITS") THAT KEEP US COMING BACK. HERE ARE SOME FAVES.

TECH SUPPORT MACGYVER

Users encounter tricky situations and use minimal resources to resolve them in creative ways, just like the hero of the '80s TV show that the subreddit is named after.



BAD TAXIDERMY

Comical mishaps can occur when attempting to preserve an animal after death in order to keep it on the mantel or as a conversation piece.

PERFECT LOOPS

This community collects mesmerizing or delightfully silly animated gifs that are designed to loop seamlessly, forever.

FOOD PORN

It's safe for work, but these crisp, hi-res images of delicious-looking meals are not safe for an empty stomach.



IDIOTS FIGHTING THINGS

Lift your spirits with short clips of people running into screen doors or getting hit in the junk.



BROTIPS

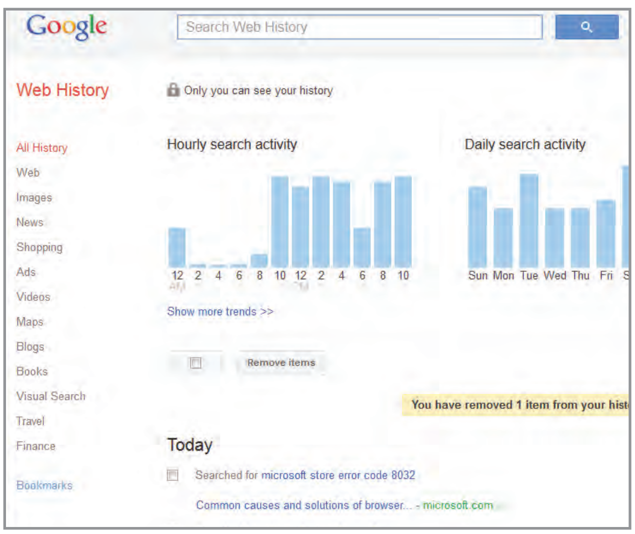
MAN UP Being a man isn't always easy. Luckily, there's Brotips.com to help you along the way. The site offers over 3,000 pieces of advice that encompass dating tips, philosophical anecdotes, and more. And while it's mostly proverbs for men, there are some pearls of wisdom for women, as well.
www.brotips.com

NET FOR BEGINNERS

EVEN OLD HANDS WILL LEARN SOMETHING NEW While Net for Beginners is a great website to help introduce your grandma to the Internet, it also explains the origins of many Internet tropes that power users take for granted. For instance, did you know that the word "meme" is derived from the Greek word "mimema," which means "something imitated"? The site houses many more of these interesting Internet factoids.
http://netforbeginners.about.com

GOOGLE WEB HISTORY

YOUR EVERY MOVE RECORDED It's no surprise that Google keeps a record of every interaction you make with its services, but when you look at Google Web History, that fact becomes eerily clear, right down to your personal trends and charted activities. If that's too spooky for you, the site also gives you the option to delete all this data.
https://history.google.com



BT LONDON

320 BILLION PIXELS OF PANORAMA It's not about the megapixels, my friend. Today, gigapixels call the shots, and the current record is held by this 320-gigapixel—or 320-*billion*-pixel—panorama of London. The shot was stitched together from 48,460 frames shot above London using four Canon EOS 7Ds and 400mm lenses. The panorama lets you zoom in with incredible detail to examine the city's very nooks and crannies.
http://btlondon2012.co.uk/pano.html

LAS VEGAS CAMS

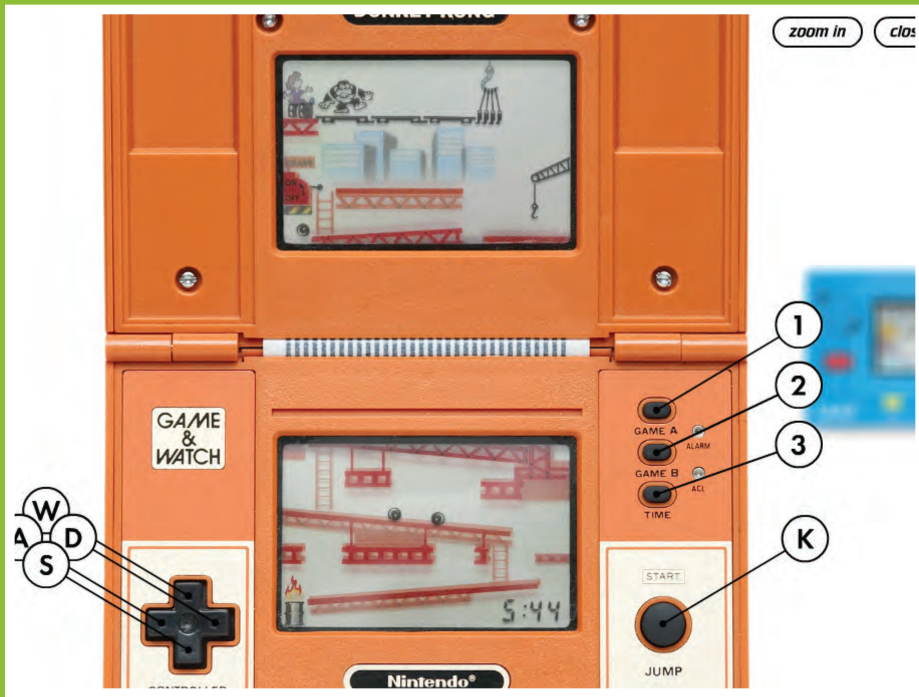
YOUR VICARIOUS VEGAS WEDDING Nothing says happily ever after like driving to Las Vegas and getting hitched—by an Elvis impersonator. Having it broadcast to the world over the Internet only cements the union, right? You get to bear witness to such matrimonial hijinks from the front-row seat of your computer screen.
http://bit.ly/596zl

VISUAL.LY

INFOGRAPHICS 'R' US In this juiced-up, multitasking world, where there's barely time to read the CliffsNotes or even a Wikipedia entry, you can just mainline your data through Visual.Ly's infographics. Follow the rise and fall of the Wu-Tang Clan, for example, or learn how the Starfleet delta shield evolved. You'll be amazed at what you can learn through pictures.
http://visual.ly

INTERNET MAP

WHOSE IS BIGGER? Does Yahoo own a bigger piece of the Internet than Google? OK, the answer to that is pretty obvious. But you might be surprised by the size relationship between Google and, say, Maximumpc.com, or any of the other 350,000 top websites represented by the Internet Map. You can easily lose yourself scrolling through this data-driven universe of planetoid-shaped objects.
http://internet-map.net



PICA-PIC

HANDHELD GAMING Every once in a while, a website comes around and reminds you how awesome the Internet is. Pica-Pic is one of those sites. It's like a time machine, taking you back through all those retro handheld games you grew up playing. Quite frankly, we're surprised Nintendo and other game publishers haven't sued this site off the web. Just in case the end is nigh, enjoy it while you can!
www.pica-pic.com

5-SECOND FILMS

THE TINIEST OF TIME WASTERS OK, many of these short films are actually a little longer than five seconds, but not by much. Don't be surprised if you find yourself spending many minutes on this site, just seeing how each of these brief-but-humorous sketches plays out.
http://5secondfilms.com

OUTGROW.ME

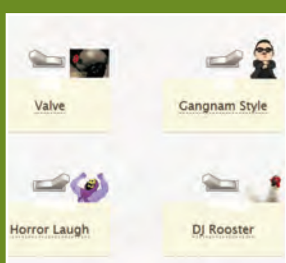
THE MARKETPLACE OF IDEAS You've heard about Kickstarter and its ilk, but you've probably never heard of Outgrow.me—an online store devoted to the sale of successfully crowdfunded products. Even if you're not in the market for a bra that holds a smartphone or a vehicle called a "scrooser," it's fun to see the fruits of modern innovation and entrepreneurialism.
http://outgrow.me

WHERE COOL THINGS HAPPEN

PHOTOS THAT WILL WOW YOU It's hard not to get sucked into this photo blog, which chronicles interesting places and events from around the world. From mass animal gatherings to 3D latte art to buildings inside caves, you're sure to find something here that amazes you.
www.wherecoolthingshappen.com

Fun with Audio

WITH AN EMPHASIS ON SOUNDS, THESE SITES ARE NO LESS ENTERTAINING THAN THEIR VISUALLY ORIENTED BRETHREN.



FUN SWITCHER

Just click a switch and be treated to an accompanying sound clip. The real fun is in mixing different sounds. Gangnam Style and Skeletor laughing? It's strangely mesmerizing!
www.funswitcher.com



GORDON MAH UNG SOUNDBOARD

You don't have to wait for our biweekly No BS Podcast to hear Deputy Editor Gordon Mah Ung go off on Apple, Ewoks, and other random things that piss him off.
www.leedash.com/rantsoundboard



MUSEUM OF ENDANGERED SOUNDS

You're sure to feel a touch of nostalgia when you visit this site, which pays tribute to the long-forgotten sounds of old technologies. Think: dial-up Internet, rotary phones, and the Windows 95 startup, to name a few.
savethesounds.info



LETTERS OF NOTE

IN THE WORDS OF FAMOUS PEOPLE What do the philosopher Seneca, former president John F. Kennedy, and music producer Steve Albini have in common? You can find letters that they actually wrote reprinted on this site, which provides an archive of personal and professional correspondences of public figures.
www.lettersofnote.com

WHITE WHINE

FIRST-WORLD PROBLEMS INDEED! An appalling, but also extremely entertaining, glimpse into the psyche of the terminally self-centered. You'll find random bitching about Starbucks orders, out-of-stock iPhones, and the indignities of flying coach, among other complaints of the entitled, gathered from around the web.
www.whitewhine.com

IMPACT: EARTH!

FUN WITH SCIENCE This site created by Purdue University lets you set specific parameters to calculate the impact of a given object being hurtled toward Earth. What's not to like?
www.purdue.edu/impactearth

UNNECESSARY KNOWLEDGE

GET YOUR FACT FIX Next time you're bored and looking for a way to kill time, you can either *numb* your mind with a video of someone doing a face plant, or you can *enrich* your mind with a randomly generated fact. It might not change your life to know that pigs sleep on their right side, for instance, but this site will give you plenty of conversation fodder.
www.unnecessaryknowledge.com

DON'T EVEN REPLY

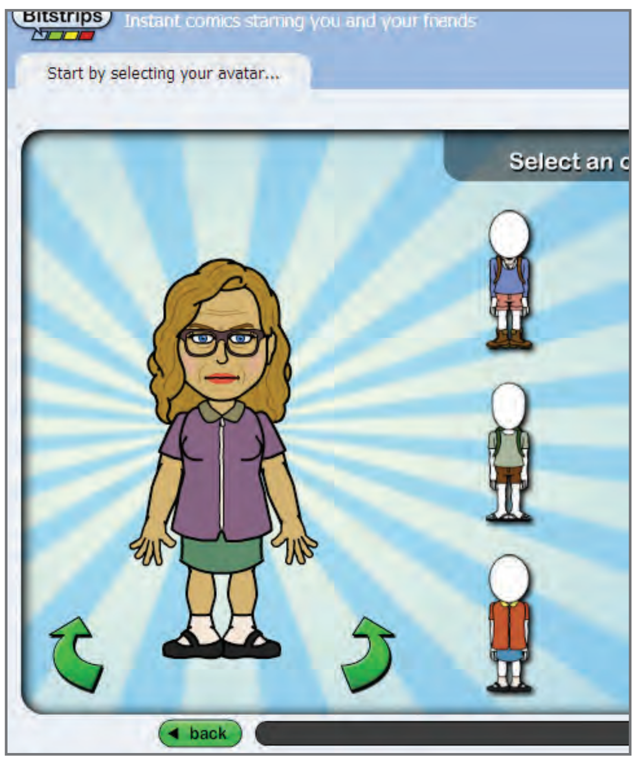
TAKE THE BAIT, IF YOU DARE This site reads like the private diary of a professional online troll, and it's effing hilarious. By harmlessly answering ads on Craigslist with unbelievable but earnest-sounding replies, this gentleman truly elevates the act of messing with people to an art form. We know it's kind of messed up, but it's still a hoot.
www.dontevenreply.com

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www.freerice.com

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NATIONMASTER

EXPAND YOUR HORIZONS Geography geeks will love this one, as it encapsulates a ton of interesting trivia about the world's nations into easily digestible morsels. You can sort countries by categories like poverty, debt, murders, oil use, and lots more. It's a fun way to learn more about the world around you. www.nationmaster.com

DIFFERENCE-BETWEEN

DISSECTING THE SEEMINGLY SIMILAR We all know the difference between CAT5 and CAT6, but do you know the difference between a slug and buckshot? A diamond and a trapezoid? Tropical storm and a hurricane? This site shows you the difference between two similar things, covering every subject imaginable. Sadly, there's no PC vs. Mac comparison. www.differencebetween.net

GEOGUESSR

WHERE IN THE WORLD ARE YOU? This site drops you into an unknown location on Google Maps, lets you pan around a bit, and asks you to guess where you are located on a world map. When you choose, it tells you whether you're right or wrong, and then loads a new location. www.geoguessr.com

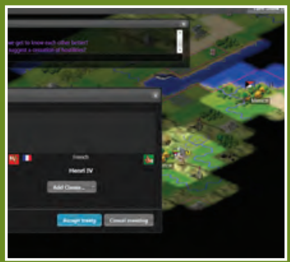
Three Go-To Games

IN-BROWSER FLASH GAMES LET YOU KILL TIME, FOR FREE, IN A VARIETY OF STRESS-RELIEVING WAYS. HERE ARE A FEW OF OUR TOP PICKS.



SUPERHOT

In this FPS, time moves at a snail's pace when you are stationary, which gives you the ability to dodge bullets and aim with crackshot precision. www.superhotgame.com



FREECIV-WEB

This open-source version of Civilization may not have all the bells and whistles of the real thing, but it's polished enough to act as a stunt double. play.freeciv.org



FROG FACTIONS

Similar to Space Invaders, you play a frog who must defend his fruit supply against a constant horde of insects, assisted by some fun ability upgrades. twinbeard.com/frog-fractions

AMD Goes for the Jugular

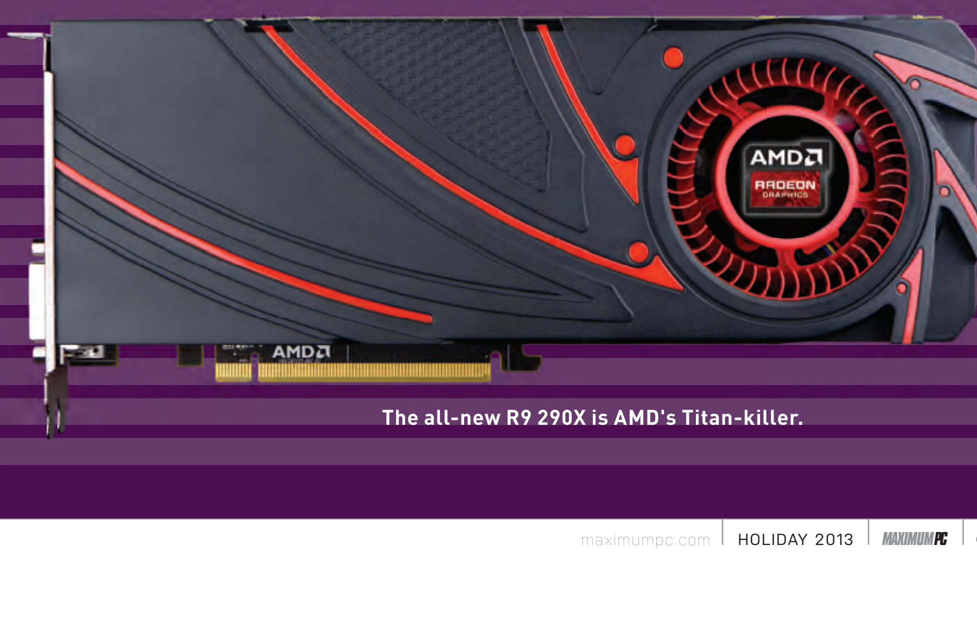
With its brand-new GCN 2.0 silicon, in-chip programmable audio DSP, and all-new low-level API for game developers, AMD is taking off its kid gloves and making an aggressive push for PC gaming dominance **BY JOSH NOREM**



FOR A WHILE NOW, it has seemed to the casual observer that AMD was sort of sitting on the sidelines of the GPU wars, content with its next-gen console "design wins" but not overly concerned about losing the discrete-GPU gaming market to Nvidia. Sure, it was competitive with the HD 7970 last year, and the HD 7990 sort of challenged Nvidia's dual-GPU powerhouse, but AMD has not been able to score a knockout punch against its primary foe in a while, and it seemingly had no answer to Nvidia's GK110-based GTX Titan, or its baby brother, the GTX 780.

As it turns out, rather than sitting on its hands all this time, AMD has been sharpening its axe, and this month it unleashed a blitzkrieg of new technology intended to not only topple the Titan, but also to capitalize on its own sovereignty in the console space by encouraging game developers to code explicitly for AMD's GCN hardware. It's easily the boldest maneuver we've ever seen AMD or ATI make, but success is hardly guaranteed, and Nvidia will not stand for this aggression, that much is assured. Read on as we walk you through the new technology piece by piece, have a look at how it stacks up to Nvidia's best, and discuss what it means for the future of PC gaming.





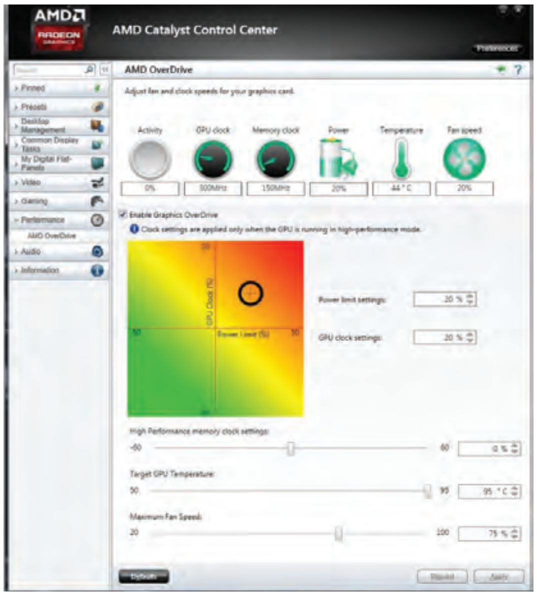
The all-new R9 290X is AMD's Titan-killer.

AMD Takes on the Titan

Standard operating procedure for graphics companies is to come out with a new architecture on a new process node every two years. In 2012, both Nvidia and AMD came out with new silicon on a 28nm process, dubbed Kepler and Tahiti, respectively. Both of those chips did battle last year as the GK104-based GTX 680 took on the Tahiti-based HD 7970. Later in the year, Nvidia threw AMD (and everyone else) a curve ball by releasing the super-size GK110, aka "Big Kepler," which used a die that packed twice the number of transistors as GK104. This mega-die delivered record-breaking performance, and easily cemented Nvidia's dominance in the single-GPU turf wars, with both the GTX Titan and eventually the GTX 780. Nvidia also respun its existing 28nm GK104 die into the GTX 770 and the GTX 760, though those were simply reboots of existing silicon with higher clock speeds, etc. That was Nvidia's arsenal coming into the winter of 2013, and the rest of us have been waiting to see how AMD would respond. It seemed doubtful that AMD could simply boost the clock speeds of its Tahiti chip enough to dethrone the GTX Titan, nor could it move to a smaller 20nm process since those chips aren't quite ready, according to reports, so what would AMD do? As it turns out, instead of boosting its existing chips, or crafting a monstrous new one, it split the difference by creating a larger version of Tahiti to do battle with the Titan (and GTX 780), while respinning its Tahiti and Bonaire chips to do battle in the midrange.

We're Going to Hawaii

AMD's new silicon is code-named Hawaii, and will arrive in the form of two new GPUs that also bear the company's all-new naming scheme. The two cards will be the flagship R9 290X, and R9 290 just below it. These are the only two cards boasting the new Hawaii chip, which is still based on the GCN architecture at 28nm, but with a significantly larger die, though not quite as large as Nvidia's GK110. To put it in perspective, the original Tahiti core was approximately 365mm squared, packed with 4.3 billion transistors. The GK110 die, however, is a massive 551mm squared, packing 7.1 billion transistors. When compared to modern-day CPUs, you can see how absolutely ridiculous these chips are, as Intel's Ivy Bridge die is a wee 160mm squared, with a paltry 1.4 billion transistors. Hawaii falls somewhere in between Tahiti and GK110 at 438mm squared, with 6.2 billion transistors. AMD has gone on record as saying GK110 is too big, and that a die that large isn't necessary to achieve what it deems satisfying performance; but, clearly, a larger die than the Tahiti was necessary to battle the Titan, and AMD has delivered that with Hawaii.



New Catalyst Control Center OverDrive options let you more easily fine-tune the card's performance.

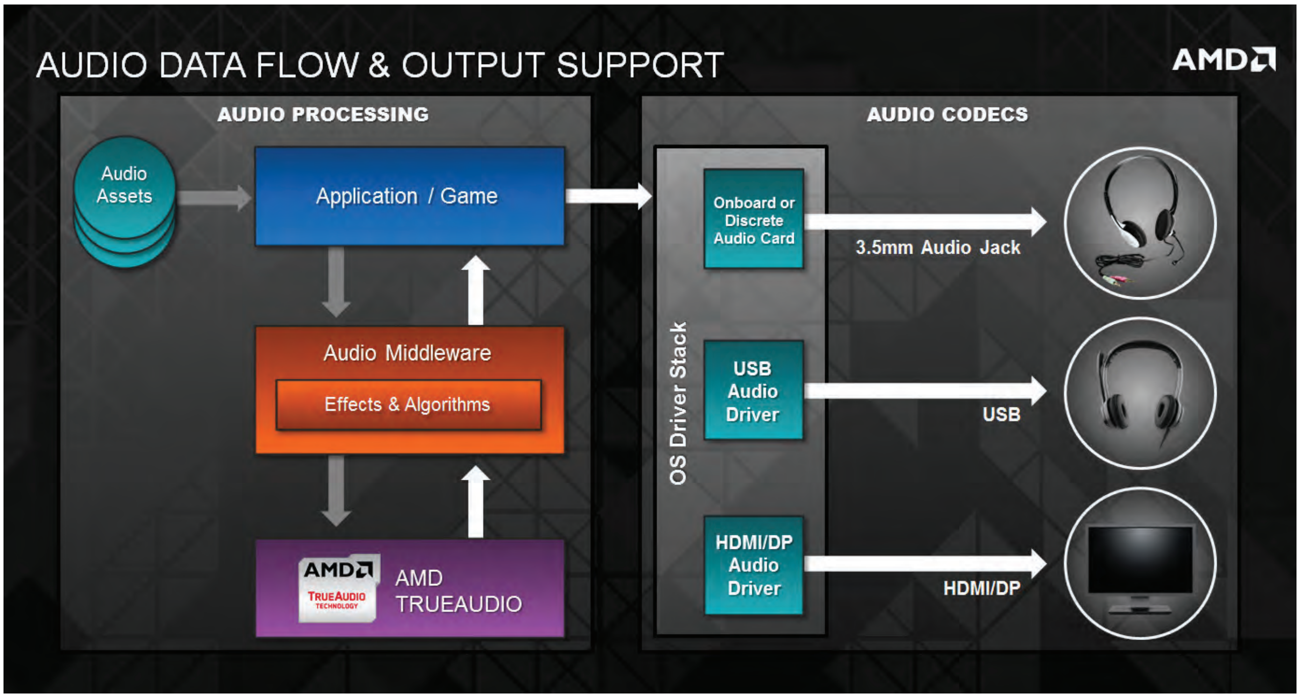
Compared to Tahiti, the Hawaii die has more of everything. Stream processor count has gone up from 2,048 to 2,816 on the 290X (the R9 290 has 2,560). Memory has been bumped up from 3GB to 4GB total on both cards, and their memory bus has been widened from 384-bit to 512-bit, as well. All these upgrades boost not only frame rates, but also compute performance, which has always been AMD's strong suit. Single-precision performance has grown from an already impressive 3.79 TFLOPS to 5.6 TFLOPS on the 290X and 4.9 TFLOPS on the R9 290. For comparison, the $1,000 GTX Titan can throw down about 4.5 TFLOPS, so AMD should retain its market leadership in compute with the R9 290 cards. Of course, all those transistors require a bit of go juice, but TDP numbers were unknown at press time.

The new R9 290 boards will also jettison the rickety CrossFire bridge, opting instead to have the cards communicate directly over the PCI Express bus. AMD said it made this move in order to accommodate the bandwidth required by Ultra HD resolutions that will be coming to the market in the near future.

SPECIFICATIONS

	R9 290X	R9 290	R9 280X	R9 270X	R7 260X
Price	$550	N/A	$300	$200	$139
Number of Cores	2,816	2,560	2,048	1,280	896
Base Clock Frequency	Up to 1GHz	Up to 947MHz	Up to 1GHz	Up to 1.05GHz	Up to 1.1GHz
TrueAudio	Yes	Yes	No	No	Yes
Memory Clock Frequency	5Gb/s	5Gb/s	Up to 6Gb/s	Up to 5.6Gb/s	Up to 6.5Gb/s
Frame Buffer Size	4GB	4GB	Up to 3GB	2GB/4GB	1GB/2GB
Memory Interface	512-bit	512-bit	384-bit	256-bit	128-bit
Manufacturing Process	28nm	28nm	28nm	28nm	28nm
Connectors	2x DL-DVI, HDMI, DisplayPort 1.2	2x DL-DVI, HDMI, DisplayPort 1.2	2x DL-DVI, HDMI, DisplayPort 1.2	2x DisplayPort, HDMI, DL-DVI	2x DisplayPort, HDMI, 2x-DVI
Power Connectors	1x 6-pin, 1x 8-pin	1x 6-pin, 1x 8-pin	1x 6-pin, 1x 8-pin	2x 6-pin	1x 6-pin
Power (TDP)	N/A	N/A	250W	180W	115W

PC Audio Back on the Menu!



AMD's TrueAudio will work with existing onboard audio, and even USB headphones.

If there's a subset of PC hardware that's long been ignored, it's audio. But that's about to change with AMD's new R-series GPUs that integrate advanced audio capabilities—called True-Audio—right into the card.

Yes, you heard us right—audio in a GPU. AMD's ambitious plan to improve PC audio isn't exactly straightforward, though. You won't, for example, be plugging your analog headset or speakers into the back of a new R-series GPU. If you're confused, we're not surprised. It takes a few minutes to understand AMD's audio play.

With the R9 290X, R9 290, and R7 260X parts, the company has integrated high-end audio DSPs, created a new API, and hopes to give game audio the same magic that programmable shaders gave graphics.

The path to audio on an AMD GPU has been building for some time. AMD's 2000-series first carried audio over HDMI in 2006; the Radeon HD 3660 added DisplayPort audio. In 2009, AMD integrated high-bit-rate audio over HDMI in the 5800 series, and the 7900 series added Discrete Digital Multi-Point Audio—or the ability to stream multiple audio sources to multiple HDMI devices.

The R9 builds on that capability by integrating three Tensilica HiFi 2 EP DSPs, as well as other Tensilica hardware, into the cards. This audio hardware doesn't replace the onboard motherboard audio, though—you know, the actual digital-analog converters and analog-digital converters and the audio codecs. The way AMD has architected TrueAudio, a game would talk to middleware, which would interface with the TrueAudio's API. Once the audio is processed, it's then spit out to your onboard audio or even a discrete sound card, USB headphones, or HDMI or DisplayPort interface. This also cleverly circumvents Microsoft's clock block on hardware-accelerated audio. With Windows Vista, Microsoft jettisoned hardware acceleration, making it difficult for games to talk directly to the sound card's hardware.

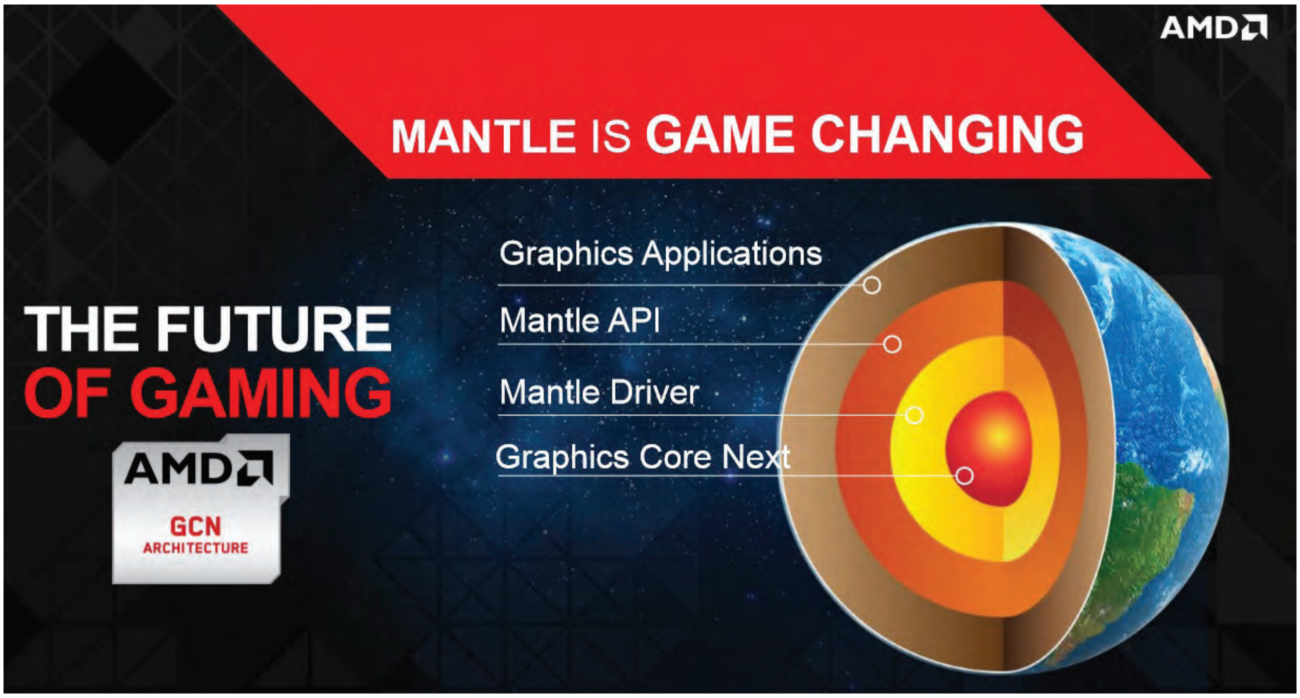
That's just the train track for the audio. Where AMD believes it can generate excitement over PC audio again is with the software. AMD is working to integrate libraries from GenAudio and McDSP for TrueAudio. Older HRTF, or head-related transfer functions, used microphones stuffed into simulated heads to model their algorithms. GenAudio says its AstoundSound's algorithms are based on measuring how the brain responds to sound. The company claims BRTF (brain-related transfer functions) are far more effective than HRTFs. How McDSP fits into this isn't known yet, but the company's IP lies mostly in professional music fields.

All this, of course, won't work without the GPU. AMD says the math involved to process advanced audio can't be done on a CPU—it needs GPU compute performance to get the job done. And despite the typical gamer having a quad-core or more today, there's still not enough CPU budget to go around, the company says.

We still have a lot of questions, of course. The biggest one is whether AMD can build widespread developer interest in its new audio API. Audio tends to be low on the priority list for most game developers, and coding for one specific API that's only available in a very few PCs isn't likely to happen without direct development from AMD itself.

We saw that same pattern with Aureal's A3D 2.0 as well as Creative's EAX 5.0. Both were quite advanced for their time, but developer support was fleeting. With TrueAudio limited to AMD cards—and just three of them right now—developer support will be the biggest factor for the technology to succeed where others failed.

Destroying DirectX 11 with Mantle



AMD has developed its own low-level API in order to let game developers more easily optimize their titles for AMD's GCN hardware.

Easily the most surprising "Ace up its sleeve" announcement from AMD concerns its all-new low-level API named Mantle. Designed as a way for programmers of PC titles to gain the type of low-level access to hardware enjoyed in the console world, where programming is done for a specific piece of hardware, Mantle represents the most disruptive piece of technology in our collective memories. According to AMD, Mantle sprung forth as a way to address the needs of game developers who are currently frustrated by having to code games in a way that takes advantage of a huge swath of technology, ranging from integrated Intel GPUs (currently the most popular GPUs in the world, according to the Steam survey) all the way to triple GTX Titans. The only way developers can cover this much ground with their code is to program it using Direct3D and DirectX, which can then talk to said variety of hardware. This is obviously extremely inefficient, but has been inescapable given the PC gaming hardware landscape. But what if developers could program their games *specifically* for AMD hardware? We're sure Nvidia and Intel wouldn't be too happy about that, but that is essentially AMD's goal with Mantle (in our estimation, at least). The only reason AMD can even get away with such a bold maneuver is because its GPUs are in all of the next-gen consoles, so game developers will be optimizing their games to run on those platforms already; why not just keep the ball rolling and program some AMD-specific optimizations for the PC, too? AMD is hoping developers will choose this path by making their games with Mantle, as the benefits supposedly are numerous and non-trivial.

Inside the Core of Mantle

At its core (pun intended), Mantle is a low-level API that allows developers to optimize code specifically for AMD's GCN hardware, which includes the HD 7000 series cards as well as the R9 and R7 variants. Therefore, instead of creating code that can only talk at a high level to DirectX, which then talks to the hardware through the API and driver, Mantle will allow developers low-level access to the hardware, which should theoretically allow for massive performance improvements. AMD claims it will allow for nine times more draw calls per second over other APIs by reducing CPU overhead and allowing direct access to all of the GPU's features. Whether or not this will actually work in the real world with shipping titles remains to be seen, but the first title to ship with Mantle support is Battlefield 4, which should be available by the time you read this. You won't be able to run it in "Mantle mode" just yet, though, as AMD has set its rollout date for December 2013. At that time, anyone running one of the above-mentioned cards should be able to run the game in Mantle mode, and to see what all the hubbub is about. For what it's worth, when Mantle was unveiled to the media, an AMD spokesman said the R9 290X would "ridicule" a GTX Titan when running in Mantle mode in Battlefield 4.

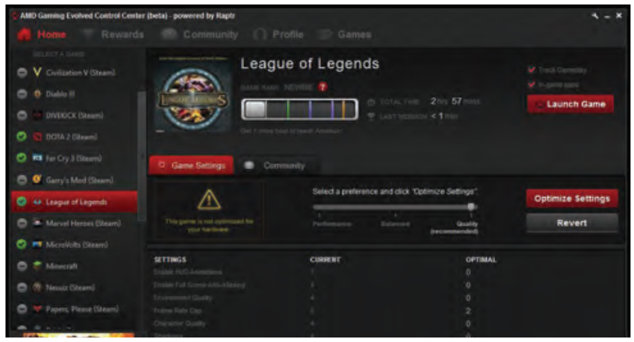
What also remains to be seen is whether other game developers will include Mantle support for their upcoming titles. As of press time, AMD was showing off a slide that lists other Frostbite 3 engine–powered games (this is the engine used for BF4), which includes Mirror's Edge 2, Dragon Age: Inquisition, and Star Wars: Battlefront. Activision will also reportedly be supporting Mantle on all its upcoming PC titles. For what it's worth, Battlefield 4 will also support Nvidia's NVAPI. Nvidia has also promised to further improve and optimize its OpenGL interface in its SDK.

AMD's Gaming Evolved Takes on the GeForce Experience

As many of you might know, Nvidia recently launched an application named GeForce Experience that is designed to take the guesswork out of tweaking a game to get maximum frame rates. A lot of people don't know how to adjust certain settings, or what things like HBAO and MSAA are for, so this app does all the work for you by using settings acquired through Nvidia's own lab testing. When we asked AMD a few months ago if it was working on a similar app, it joked that it wasn't necessary, since all the AAA titles coming out were already optimized for AMD hardware (Crysis 3, Far Cry 3, BioShock Infinite, etc.). However, it turns out that AMD has been working on a similar type of app, or at least exploring the possibilities, because it has announced a new service named Gaming Evolved, which is powered by an app named Raptr. Essentially what this app does is bring an Xbox Live, console-type experience to the PC, so your games will run well without having to jump through a bunch of hoops. On the social side, you can see what games your friends are playing regardless of platform (Xbox, PC, PS3, etc.) or publisher (Steam, Origin, Uplay).

'Game Optimization Done Right'

The tagline above is from AMD's marketing department, and it's clearly a shot at Nvidia. Instead of employing a legion of lab monkeys to test games on a variety of hardware, analyze the results, and then make them available to end users, Gaming Evolved takes a totally different route than Nvidia, which should allow it to cover a much larger number of games without any additional manpower required. What it does is log the hardware and frame rate of all users connected to the system, which according to AMD is over 18 million gamers, so that's quite a sample. After analyzing the frame rates of all the hardware configurations available to it, the application then derives what it deems optimal settings for any game for which it has data. In the app, these options are presented as a three-position slider, letting you choose from Performance, Balanced, or Quality. AMD says it will use "collaborative filtering" to weed out data that's not pertinent, and therefore be able to use data gleaned from real gamers out there playing the games instead of testers in a lab.



AMD's new app lets you optimize games with just one click, and see friends playing on any publisher or platform.

The Social Network

When we're knee-deep in the muck in Battlefield 4, the last thing we'll be thinking about is checking Facebook or Twitter, but we realize some people have addictions and need to constantly check these things. AMD understands, too, so in Gaming Evolved you don't have to Alt-Tab out of a game to look at your web browser; you can access your social networks from within the game itself—or any game. Just please don't do it while taking point in Battlefield 4.

Even more impressive than the fact that you can see what everyone thinks about your most recent meal in real-time is the fact that Gaming Evolved lets you see other gamers using different platforms and playing games from competing publishers. It's high time we had something like this, as having to run Steam and Origin is just a pain, and most of us do it because there's no simple solution. Perhaps this application will solve that problem, though we'll have to wait and see when it comes out of beta.

To entice gamers to check out Gaming Evolved, AMD is ponying up over $20 million in rewards just in 2013 alone—how that translates in the real world remains to be seen. What AMD has stated so far is that there will be in-game perks just for playing, such as DLC, in-game items, discounts, and other extras, similar to achievements but with tangible benefits.

YOUR MOVE, NVIDIA

The battle lines in the GPU wars are usually fought along one front, and that is hardware. With AMD's recent announcements though, Nvidia finds itself under attack on several fronts. Possibly the easiest to deal with is the hardware front, and as we went to press, Nvidia announced a GTX 780 Ti to compete directly with the R9 290X. Sadly, we have no further details, but it will likely put a cramp in AMD's plans. The Gaming Evolved app battle most likely won't amount to a hill of beans, because nobody is going to switch GPU brands for an app like this, plain and simple—that goes for Nvidia, as well. The most difficult fight the company has on its hands is with Mantle, and that's only possible because AMD has its GPUs in all the next-gen consoles, and it would sure love it if all game development going forward was specifically optimized for its hardware. It's somewhat reminiscent of 3dfx and its Glide API, which rocked for the small number of games that supported it, but never quite caught on before 3dfx disintegrated. The same fate could await Mantle, and we are sure developers won't ever cut Nvidia out of the development process, given that it has the largest market share when it comes to discrete graphics. We're sure Intel and Sony aren't too happy about Mantle either, and Intel is the biggest market-share holder in the GPU industry as a whole, so DirectX, OpenGL, and Direct3D aren't going anywhere anytime soon.

Benchmarks and Final Thoughts

AMD's new Hawaii GPU closes the gap with Nvidia's GK110

AMD is mounting one hell of an assault against Nvidia right now, that much is clear. Instead of just rebadging its existing GCN silicon, it's gone ahead and created not only new silicon in the form of Hawaii, but is also introducing brand-new technology named TrueAudio, as well as its very own Mantle API. It's a bold move on AMD's part, and Nvidia will surely be feeling the heat.

Speaking of heat, based on our tests, the Hawaii-based R9 290X achieves parity with the much larger GK110 chips from Nvidia, but it has to be pushed to the absolute limit to achieve that level of performance. In our tests, the R9 290X ran at around 94 C under load in "quiet" mode, and its clock speeds fluttered around 900MHz to keep its temps in check. In "silent" mode the cooler's fan always runs at 40 percent, and it's certainly quiet. In "uber" mode the fan spins much faster, and is much louder, so we don't recommend it. In either mode, this card runs very hot, but AMD says it is of no concern and is how it was designed, and we didn't see any instability whatsoever in our tests. It looped Heaven 4.0 for several days hovering at 94C the whole time.

As it stands, the R9 290X is close enough to the GTX Titan and GTX 780 to call it a tie, so AMD has matched the GK110, but Nvidia's Kepler boards still run cooler and produce less noise. However, the R9 290X's $550 price tag makes it extremely competitive against the Titan and the GTX 780. The lingering question, of course, regards the added value of AMD's extra features, namely TrueAudio and its Mantle API. We'll have to wait and see on those counts, but it's safe to say that for now, AMD has certainly leveled the playing field at the high-end of the GPU market, so picking a "winner" is impossible at this time.

Things are a bit easier to peg in the mid-range, as the R9 280X is the clear leader at not only its price point but also the price point above it. The R9 270X and R7 260X are great cards too, giving AMD an incredibly promising product stack heading into 2014. And it's going to need it, as Nvidia is expected to introduce all-new 20nm technology in 2014 named Maxwell that uses embedded DRAM. AMD will surely counter attack, however—and round and round we go.

2560X1600 BENCHMARKS

	R9 290X	GTX Titan	GTX 780
Driver	13.11 beta 5	327.23	327.23
3DMark Fire Strike	9,789	**9,859**	8,602
Unigine Heaven 4.0 (fps)	30	**36**	32
Unigine Valley 1.0 (fps)	39	**52**	43
Crysis 3 (fps)	28	**31**	25
Far Cry 3 (fps)	31	**41**	36
Tomb Raider (fps)	24	**26**	20
Metro: Last Light (fps)	17	**22**	20
Battlefield 3 (fps)	52	**53**	48

Best scores are bolded. Our test bed is a 3.33GHz Core i7-3960X Extreme Edition in an Asus P9X79 motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 7 Ultimate. All tests are run at 2560x1600 with 4X AA except for the 3DMark tests.



AMD's R7 260X includes support for both Mantle and TrueAudio.

1920X1080 BENCHMARKS

	Asus R9 280X DC2 Top	Asus GTX 760 (Reference)	GTX 770 (Reference)	R9 270X	Gigabyte GTX 660	R7 260X	GTX 650 Ti Boost
Driver	13.11	327.23	327.23	13.11	327.23	13.11	327.23
3DMark Fire Strike	**7,853**	5,715	6,965	5,583	4,720	3,806	3,922
Unigine Heaven 4.0 (fps)	43	35	**44**	30	30	19	22
Unigine Valley 1.0 (fps)	62	53	**63**	44	43	28	36
Crysis 3 (fps)	**39**	31	37	25	25	17	22
Far Cry 3 (fps)	**48**	39	46	34	32	21	27
Tomb Raider (fps)	27	23	**30**	24	19	15	15
Metro: Last Light (fps)	24	18	**29**	16	15	11	16
Battlefield 3 (fps)	**46**	32	38	29	27	32	22

Best scores are bolded. Our test bed is a 3.33GHz Core i7-3960X Extreme Edition in an Asus P9X79 motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 7 Ultimate. All tests are run at 1920x1080 with 4X AA except for the 3DMark tests.

Thinking the Box

What's it like to build in three of the most unusual cases on the market? BY TOM MCNAMARA

A GENERATION AGO, computer cases were typically beige pizza box–shaped things that resided under beige CRT monitors. You wrangled floppy disks in and out of them and pressed the power button at times, but they weren't conversation pieces or personal statements. We don't know exactly when the shift to case fanciness occurred. It evolved gradually, like facial hair or Nicolas Cage. And in the last few years, we've seen some pretty exotic enclosures come to the home desktop, in various degrees of affordability and physical dimensions. You may wonder what it's like to build inside one of these strange containers; we certainly did. To find out, we had three distinctly different unconventional cases delivered to our Lab: the Cooler Master HAF Stacker 935, the In Win D-Frame, and the Corsair Carbide Air 540 that are pictured here.

With the help of our trusty intern Sam Ward, we built complete systems inside each of these enclosures, and we document the experience in the following pages of this article. We've refrained from giving the cases verdicts, since the Cooler Master HAF Stacker is a pre-production unit and could change from what will ultimately end up on store shelves. But expect to see verdictized reviews in a future issue.



Outside



COOLER MASTER HAF STACKER 935

THE VOLTRON OF PC BUILDING

With our Stacker 935 fully assembled, the black mega-tower looked like something a super-villain would use in his or her secret lair. It measured over three feet tall, for Pete's sake, nine inches wide, and nearly two feet long. The Stacker 935 consists of one small ITX unit about 9 inches tall, and one large unit about 19 inches tall, with an MSRP of $170, for a total height of about 28 inches. You can't buy the big one by itself, but you can grab as many of the small ones as you like, and then stack them according to your needs. The small unit is called the Stacker 915 and retails for $70. Our combo of choice, pictured for your amusement, is a 935 and a 915, which Cooler Master sells as the "945." For comparison, a Corsair 900D is about 27 inches tall, and the inside of a Cooler Master Cosmos II is about 22 inches tall (the external handles add some extra height).

In this pre-production unit, the cases attach to each other with a sliding mechanism, which you lock into place with a set of provided screws. Each compartment also comes with detachable feet and a detachable top panel, so you have flexibility in your stacking arrangement.

The 915 is limited to ITX motherboards, but it's pretty wide open otherwise; the "F" variant gets its PSU in the front, and the "R" variant has one in the rear. But while the 915R won't give your CPU room for more than a stock air cooler, you can fit a water-cooling pump pretty easily, and a radiator and fan would mount on the side panel. The 915 also takes up to three drive cages, each containing three 3.5-inch drives, for a total of nine. Each of those nine slots can also take two SSDs if you have an adapter kit. If you limit your video card length to eight inches or less, you can fit an ITX motherboard and two cages.



While you're free to arrange your Stacker cases in any order, Cooler Master recommends that you not add more than two smaller 915 cases to the basic 935 setup, lest the tower tip over.



You can swap drive cages freely between the big case and the small cases; they attach with four standard screws.

For system cooling, each side panel will accommodate a 360mm or 280mm radiator. That's probably overkill for the ITX system itself, but a custom liquid-cooling loop for a system located in the mid-tower can take advantage of this additional space. Cooler Master recommends quick-disconnect couplings for such a setup, so that the two cases can easily detach from each other even after the loop is installed. The stock 915 comes with a front 92mm fan, and the mid-tower ships with dual 120mm intake fans and one 140mm rear exhaust fan. The mid-tower's intake fans can fit inside the front bezel, to maximize room inside the case.

With such unusual dimensions come some unique building challenges. For one, it can be a long way for drives to connect from the 915 to a motherboard installed in the mid-tower. The same goes for a power supply located in the large compartment. To assist, Cooler Master will sell SATA extension cables for data; SATA power-cable extenders will come in a kit that bundles an extra drive rail and "quick detach pins" that replace the screws that connect Stacker cases to each other. The pins will also be sold separately. (You can also buy extenders for data and power from stores like Newegg and Amazon.) Pictured here is the side panel with the 200mm fan. The stock version gets a plain window panel.

Other than sheer cable length, the systems were not difficult to put together. The cases are all roomy with plenty of cable management space, and the drive cages can be moved around to multiple spots.

Cooler Master HAF Stacker 935

$170, www.coolermaster-usa.com



1. In this config, the top case is a semi-portable HTPC unit powered by an AMD A10-6800K. It doesn't share any cabling or devices with the system underneath.

2. The gap between the cases is about an inch tall, so we have plenty of room for this Corsair H100i CPU cooler to blow exhaust out the top of the larger case.

3. The 915 has dust filters on its side panels; they're attached with four screws.

4. The larger case ships with two 120mm intake fans in the front, and one 140mm exhaust in the rear.

IN WIN D-FRAME

IF YOU'VE GOT IT, FLAUNT IT

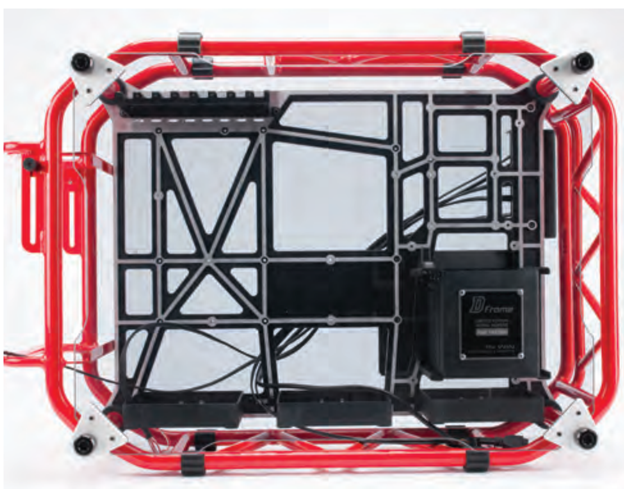
The industrial-looking In Win D-Frame was probably the most interesting to put together. If you're a fan of K'Nex or Tinkertoys, you'll be right at home attaching the four red pieces to each other and to the silvery mounting plate in back. When you're done, you'll be rewarded with a unique, all-aluminum frame, two tempered glass panels, and a fun 90-degree rotation from the standard direction (so your video cards will be vertical, for example). Despite its aluminum frame, the tempered glass makes the case surprisingly heavy, tipping the scales at 25 pounds before you start installing your hardware.

The aluminum is supposed to help with heat dissipation, which itself is aided by a set of fans installed in the bottom of the case, blowing upward. The D-Frame comes with no fans of its own, as people who are paying the $400 price tag usually have a set of their own. We had to settle for a few Scythe Gentle Typhoons. It's a hard-knock life.

The rotation throws off some sizing estimations, admittedly. Minus the power supply cage in the back, the D-Frame is about 22 inches long and 19 inches tall. The width is a little misleading, due to the frame extensions that support the glass panels; inside, you'll actually have no more than six inches for an air cooler. So, we'd recommend a liquid-cooler instead. We used a Silverstone TD03 here; despite its extra-thick radiator and dual fans, it installed in the rear with plenty of room to spare. If you remove the 3.5-inch drive cage, the D-Frame could easily support a thick 240mm radiator as well. (And without the cage, there are still several storage device mounts built directly into the frame.) Our fan/rad combo hangs off of two circular brackets attached to the frame with a couple of screws. A fourth fan would usually go there if we weren't using liquid cooling, but these brackets have no problem with the heavier load. The power-supply cage is also spacious, holding a Corsair AX1200i—eight inches long—with room to spare.



It may be heavy, but that tempered glass provides an awesome view of your beloved parts. Sloppy builders need not apply.



Despite its appearance of complexity, the D-Frame needs only a standard Phillips screwdriver to assemble.

Video card length is basically a non-factor. There's about 13 inches of space in that area, and you can remove the fan bracket to add a couple more. We slapped a trio of Nvidia GeForce GTX 780s in there without breaking a sweat. The close proximity of the power supply cage makes hooking up the cards easy. The power supply can be oriented in two different directions; we chose this orientation because it shows off our pretty braided cables, in a patriotic selection of red, white, and blue. When your side panels are made entirely of glass, you can't skimp on the little visual details. Note that there are no other panels shielding the inside of the case, so foreign objects can fall in if you're not careful. On the other hand, this semi-open design makes tinkering a lot easier. You could ditch the panels altogether, if you don't have any pets or small children around.

Lastly, this case is getting a limited run of 500 units, though that's apparently just for this red version. The orange version gets its own 500-unit run. Each one is stamped with a serial number—ours is 187. The point is, it won't be around forever. Though with this rugged design, the case itself may very well outlive you.

In Win D-Frame

$400, www.inwin-style.com

> WHEN YOUR SIDE PANELS ARE MADE OF GLASS, YOU CAN'T SKIMP ON THE LITTLE VISUAL DETAILS



1. You can orient the power supply any way you want, but we recommend positioning its intake fan on the outside, so that it's not competing with the video card(s) for air.

2. For a little variety, we went with an AMD FX-8350 CPU on an Asus Crosshair V Formula-Z motherboard. Can't let Intel hog all the fun.

3. There's nearly three inches of space between the back of the motherboard and the side panel, so cable routing is very manageable.

4. Because of the extra length of this case, even a radiator and fan combo as bulky as the Silverstone TD03 fits in the back with room to spare.

CORSAIR CARBIDE AIR 540

IT'S HIP TO BE SQUARE

When you peek inside the Corsair Carbide Air 540, you'll probably notice that it's missing some important stuff. Like, oh, a PSU and 5.25-inch drive bays. Have you gone crazy? Are invisible elves powering this puzzling cube? No and no. All you have to do is flip the case around to view the other compartment, and you'll see the wizard behind the curtain. The 13 inches of total width give ample room for the trick. The net effect is that you can have loads of fans and water cooling for the video card, CPU, and motherboard without sacrificing storage capacity. Two 3.5-inch drive bays sit on the bottom of the left-hand side, complete with built-in SATA connectors so that you never see drive cables on that side of the case. The right-hand side (where the PSU is) gets four 2.5-inch bays for SSDs.

You may be concerned by the low number of 3.5-inch bays, but keep in mind that the two 5.25 bays in the back compartment can accommodate two such drives, with an adapter kit. We decided to put a Blu-ray drive in there instead. But keep in mind that these larger bays are vertical; not all optical drives are compatible with that orientation.

Power supplies can be mounted pretty much any way you want, though, so Corsair takes advantage of this. The PSU is rotated 90 degrees onto its side to accommodate the relatively tight space, but its cables don't have to be clean here, since there's no window and just empty space between the PSU and the front of the case. This relaxed design makes it a lot easier just hook up everything and go, rather than taking painstaking steps to zip-tie every cable for maximum cleanliness. Nobody likes their side panel to bulge because they couldn't route everything smoothly, and here, you don't even have to think about it. The power supply can also be virtually any length. The lower right-hand corner of the panel has a grill, so the PSU can pull cooler external air.



The Carbide Air 540's looks are reminiscent of the cube-shaped boxes found in server rooms, miniaturized for the home desktop.



The left-hand "chamber" is eight inches wide, leaving five inches on the other side for the power supply and 5.25-inch drive bays.

The front of the case will take a 280mm or 360mm radiator—we installed the Corsair H110, which uses a 280mm rad. There was even room to put fans on both sides for "push-pull," using the two stock 140mm front intake fans. This increases airflow through the rad, so the liquid that returns to the pump contains less heat and can therefore absorb more, before it's pumped back to the radiator. We still had room for an Asus DirectCU II GeForce GTX 770, which is 10.7 inches long, but it was tight—a card with PCI Express power connectors on the end instead of the side would not fit in this config.

Meanwhile, you could add two 140mm fans in the top, though a push-pull setup didn't have quite enough space. The rear has a 140mm exhaust fan pre-installed. You can place a 140mm closed-loop radiator on top of it without obstructing anything—a feature usually only seen in full-tower cases. The rear will also take a 120mm fan, and the top will take two 120mm units, or one 240mm radiator.

Back to the PSU side, there's room between it and the front of the case for a liquid-cooling reservoir and pump, but it will require some cable tidiness, especially if you're using two or more video cards. The rear of the case does not have pre-cut holes to route tubing to an external rad or reservoir, so your loop will need to be completely internal, unless you're prepared for a little DIY.

Corsair Carbide Air 540

$140, www.corsair.com



1. Since the 5.25-inch drive bay is in a hidden chamber, you can wire up a fan controller back there without revealing much of the cable routing.

2. Our distinctively orange stunt motherboard for this rig is the Gigabyte GA-Z87X-OC, a quad-SLI board that retails for around $200.

3. The Air 540 has built-in motherboard standoffs with a central "guide" post, which shaves installation time down even further.

4. Because the power supply is laid on its side, it shouldn't need extension cables to reach the 8-pin CPU power connector at the top of the motherboard.

OTHER EXOTIC BOXES

A ROGUE'S GALLERY FROM THE PAST, PRESENT, AND FUTURE



mATX V5

Since mineral oil doesn't conduct electricity, it can be used to conduct heat away from electronic parts without frying them. Puget Systems has developed a kit that you can buy and assemble Ikea-style. We hope to take a closer look at this one in a future issue.
$690, www.pugetsystems.com



In Win Tou

The D-Frame is just one of In Win's many distinctively designed cases. The Tou looks relatively conventional at first glance, until you turn on its purple internal LEDs. Then the angled, smoky glass panels clear up and reveal everything inside, bathed in an eerie glow.
Price TBA, www.inwin-style.com



Cyber Power Fang III

Cooler Master isn't the only group that's grafting cases together, though its Stacker cases are still the only modular ones we know of. The Fang III is a custom design from system builder CyberPower PC, reserved for its top-end systems.
Price varies, www.cyberpowerpc.com



Zalman TNN500A

The Zalman TNN500A is not a new case, but it would be criminal to ignore it. It's billed as a noiseless and fanless case, using a complex network of integrated heat pipes and heatsinks, and an all-aluminum frame, though its integrated VGA cooler can no longer keep up with modern video cards.
$1,250, www.zalman.com



Lian-Li PC-U6

Though no longer available, this seashell-shaped case was one of the more whimsical mass-production designs out there. This level of chutzpah produced interesting build challenges, but it ultimately rewarded creative thinking.
Discontinued, www.lian-li.com



Antec Skeleton

Difficult to find these days, the Antec Skeleton attempted a partial "open-air" design that certainly caught the eye, with its graceful, silvery arches and massive 250mm fan. It also developed a sizable mod following before Antec shifted its attention elsewhere.
Discontinued, www.antec.com

iFixit presents:

AUTOPSY

THIS MONTH WE DISSECT...

Fitbit Flex



About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com.



BACKGROUND:

The Fitbit Flex—a water-resistant pedometer, heart-rate monitor, and sleep-tracker—manages to pack a lot of technology into a device that's slim enough to wear around your wrist.

MAJOR TECH SPECS:

- Bluetooth 4.0 syncing
- Memory to store 30 days of data
- 5-day battery life

KEY FINDINGS:

• With less effort than peeling an orange, you can peel the Fitbit Flex tracker out of the flexible wrist strap. We appreciate how easy it is to separate the electronics from the wrist strap—the component most likely to wear out.

• The first things we notice on the Flex are the waterproof contacts. The Flex claims to be water-tight to 10 meters.

• This tiny gizmo fits snugly in its USB charger when its lithium-polymer battery needs juice.

• With no visible point of entry into the Flex tracker, we used a dozuki saw to remove the top of the device, and were thus able to extract the LEDs that serve as a display, as well as the Bluetooth antenna. To get at the main board, however, we needed to use a rotary tool to open the plastic casing lengthwise.

• The main board slides right away from the contact pins. Attached to the board is a round vibrator that functions as an alarm; there is also a battery encased in a thin sheet of metal tape. The battery is soldered to the board, but at this stage, a non-replaceable battery is the least of our worries. The board also holds a near-field communication (NFC) antenna.

• The two large chips on the main board are an ARM Cortex M3 Microcontroller and a Bluetooth Low Energy Connectivity IC.

Repairability score: 2 out of 10. Solid waterproofing, no moving parts, and lightweight construction make the Flex a very durable device, with the potential to last a long time. The wrist strap is similarly constructed and can be easily replaced. It's impossible to open the device without destroying it or at least compromising the waterproofing, making internal repairs infeasible. The Flex's inaccessible (and non-replaceable) battery limits the life of the device.

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

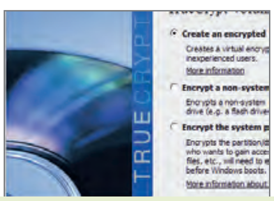
WINDOWS TIP OF THE MONTH

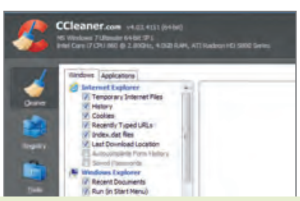


HAVE YOU UPDATED TO WINDOWS 8.1 YET?

The first major update to Windows 8 has been available since mid-October—have you made the update yet? If you haven't, now would be a great time. Windows 8.1 features enhanced customizability for the Start Screen, adds a Start button to the taskbar, and allows you to boot straight to the desktop. The update is available for free on the Windows Store.

MAKE - USE - CREATE







ALEX CASTLE
CONTRIBUTING EDITOR

TOPICS WORTH REVISITING

WHEN DECIDING on subjects for How To articles, there's always a bit of tension involved. On one hand, I want to pick topics that are exciting and new—stuff we've never covered before, and, ideally, that our readers have never heard of. On the other hand, if we stick too closely to that goal, we end up pursuing more and more esoteric topics and eventually we're writing a four-page article about the merits of manually organizing your hosts file using a braille-based text editor. That's not helping anyone.

So, while we try and keep coming up with stuff you've never heard of, I think it's important to sometimes circle back around to the basics. To that end, this month we've got guides to two of the most important utilities available: TrueCrypt and CCleaner. These might not be new to the power users out there, but I think they're absolutely essential, and I recommend that anybody who hasn't used either program in a while brush up right now.

↘ submit your How To project idea to: comments@maximumpc.com

Keep Your Data Secure with TrueCrypt

YOU'LL NEED THIS

TRUECRYPT
This free encryption program is available online at www.truecrypt.org.

IF YOU'VE BEEN following the news lately, you might be under the impression that your private data is an open book to any number of corporations, government agencies, and shadowy hacker cabals. And while it might be true that you can't guarantee the sanctity of any particular online account, you still have the power to keep any of your data safe from prying eyes. How? The solution lies in encryption—the process of scrambling the contents of a file to prevent anyone from reading it unless they provide the correct "key" to unlock it. This is typically a password, a file, or a combination of both.

Encrypting your files and documents on the fly is quick and easy, thanks to a free program called TrueCrypt. You simply set up an encrypted drive or file container, which holds all your sensitive files. When the container has been unlocked you can access its contents like any other drive on your computer. Close the container and not only do the files become inaccessible, they disappear from view, too. Better yet, the encryption in TrueCrypt is military spec—the NSA, the CIA, and S.H.I.E.L.D. could all get together and they wouldn't be able to get into a file properly secured with TrueCrypt. In this guide, we'll tell you everything you need to know to lock down your files. –NICK PEERS

1 INSTALL TRUECRYPT

Download the TrueCrypt installer from www.truecrypt.org and run it. Follow the prompts, leaving the default settings as they are (or you may wish to uncheck the desktop shortcut option), before clicking Install. Once TrueCrypt is on your system, click OK, followed by Finish. Read the beginner's tutorial when asked, if you want to familiarize yourself with it, then launch TrueCrypt.

» You can also choose to run TrueCrypt without installing it. This is a great option if you want to keep encrypted files on a USB drive or other removable media, as it allows you to keep the TrueCrypt software with you, so you can access the encrypted files from any computer.

2 CREATE AN ENCRYPTED VOLUME

With TrueCrypt installed, click the Create Volume button to get started. You have two basic choices: If there's data already on the drive that you don't want to lose, leave "Create an encrypted file container" selected and click Next (**image A**). This will create a virtual, encrypted disk that you can open at any time (with a password) and store sensitive files in. To encrypt an entire drive or partition, wiping any existing files from it in the process, choose "Encrypt a non-system partition/drive" instead, followed by Next.

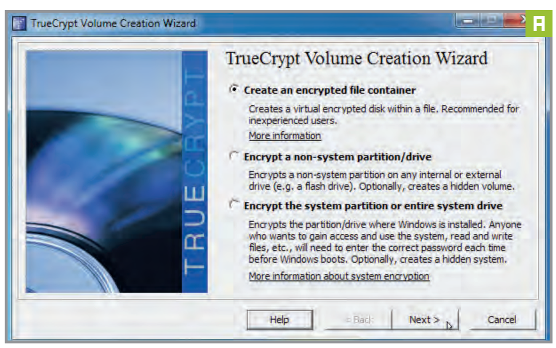
» Click Yes if prompted by the UAC dialog box. Two types of volume can be created. To simply protect the data if the drive it's on is lost or stolen, leave "Standard TrueCrypt volume" selected and click Next again (**image B**). Advanced users may want to choose "Hidden TrueCrypt volume," which allows you to create a second, dummy password that can safely be given out under duress. When the dummy password is used, a secondary TrueCrypt volume will be decrypted. By filling this secondary volume with files that look sensitive but actually are not, you can create plausible deniability if an enemy actor knows that you're using TrueCrypt. Assuming you're not James Bond, a standard TrueCrypt volume is all you need, and it's what we'll cover in the rest of this guide.

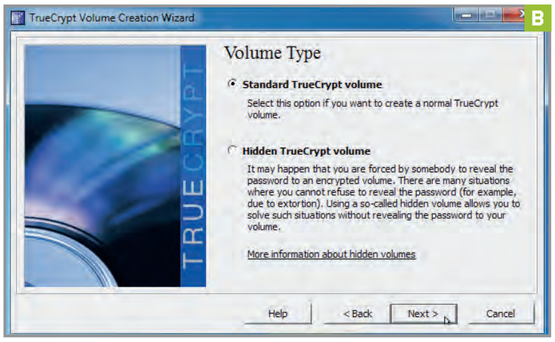
» Click the Select File button, browse to the location where you want to store your encrypted volume, and then type a new name into the File Name box (**image C**). Avoid using a file extension, as this can be problematic. Click Save, followed by Next to set up your encryption options for the volume. If in doubt, the default options should be fine for most people. Click Next to continue.

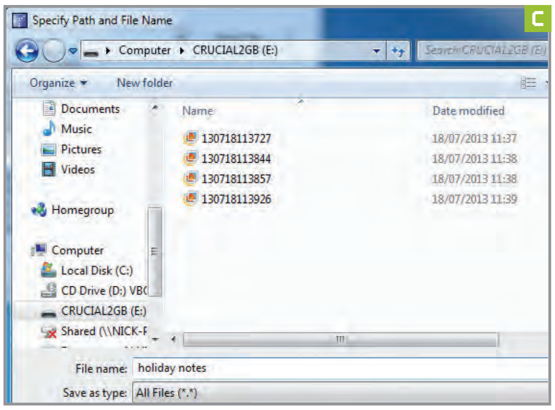
» If you're creating a file container, you'll be prompted to set a size for it. Choose a suitable figure, depending on how much data you need to encrypt and how much free space is available. Click Next to enter a password. You'll need this to access your files in the future, so make sure it's memorable, but also tough to crack. A weak password makes even the strongest encryption breakable, so try to make it at least 20 characters.

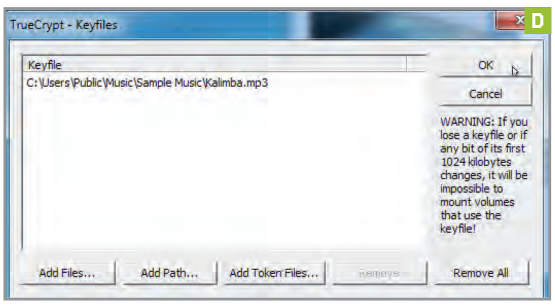
» For additional protection, check Use Keyfiles before clicking the Keyfiles button. Select at least one file—any will do (**image D**). In the future, your encrypted drive or container can only be opened by selecting that file and entering the correct password. This adds another layer of security to your files, but make sure the file is accessible when you need it. Then click OK, followed by Next.

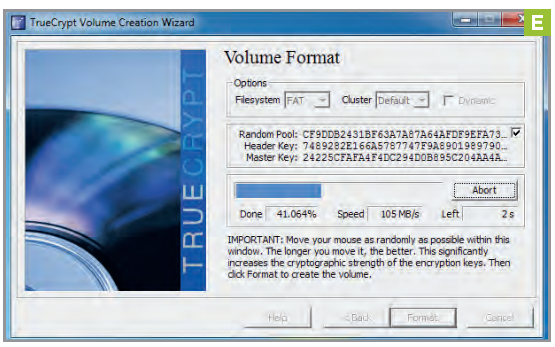
» Move your mouse within the TrueCrypt creation window for a while to generate a strong cryptographic key (**image E**). When you're ready, click Format and the encrypted volume will be created. Wait until the confirmation dialog box appears, then click OK followed by Exit to return to the main TrueCrypt window, ready to access your encrypted container for the first time.







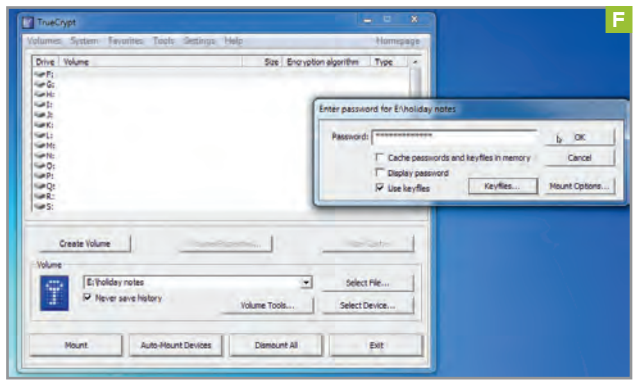


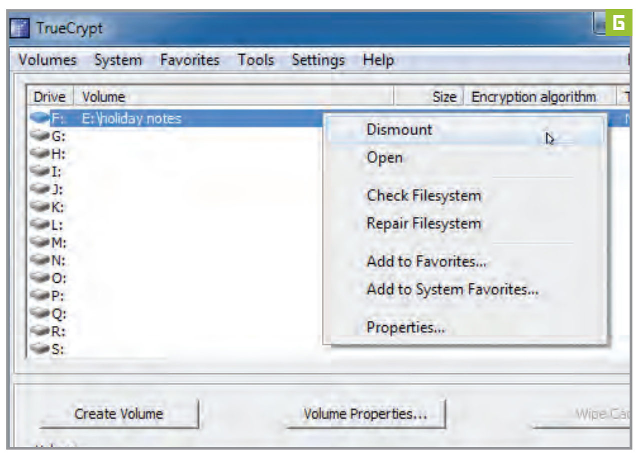


ACCESS YOUR ENCRYPTED VOLUME In the TrueCrypt client, select a free drive letter from the list. Click the Select File button to choose your encrypted container, or click the Select Device button to access an encrypted partition or drive. Click the Mount button, then enter the password and, if applicable, click the Keyfiles button to select the files that will give you access to your container when you click OK (**image F**).

» After a short pause, you should see your encrypted container appear in the main TrueCrypt window. It can now be accessed like any other drive. Copy or save files directly into here to ensure they're protected in the future. When you've finished with the drive, right-click its entry in the TrueCrypt window and choose Dismount to lock it away from prying eyes (**image G**).

» Now your files are safely stashed away behind TrueCrypt's ultra-tight encryption, and you can relax when moving them from one place to another. Without the correct password and keyfiles, no one else can gain access to your data, so even if you misplace your USB flash drive or find it's fallen into the wrong hands, your documents will remain strictly for your eyes only.





Optimize Your PC with CCleaner

YOU'LL NEED THIS

CCLEANER This system-cleaning utility is available at www.piriform.com/ccleaner. The site will encourage you to download a paid version, but there's a free version available, as well.

WE LOVE USING Windows, but the fact remains that after a while, it can start to slow down. It has to do with the way Windows handles programs, and simply using it on a day-to-day basis can result in an accumulation of unnecessary registry entries and files.

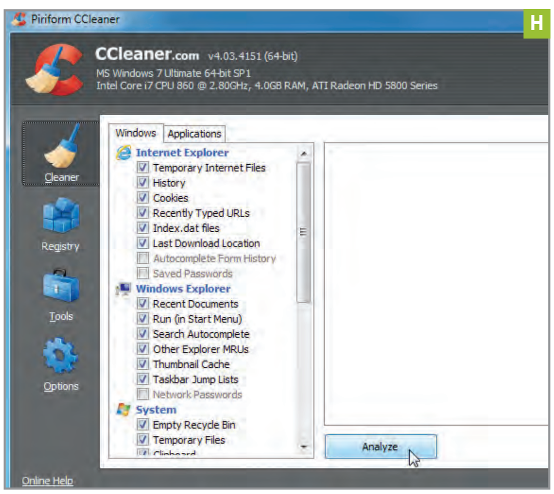
We'll show you how you can use CCleaner to clean up (and likely speed up) your system right now. –HENRY WINCHESTER

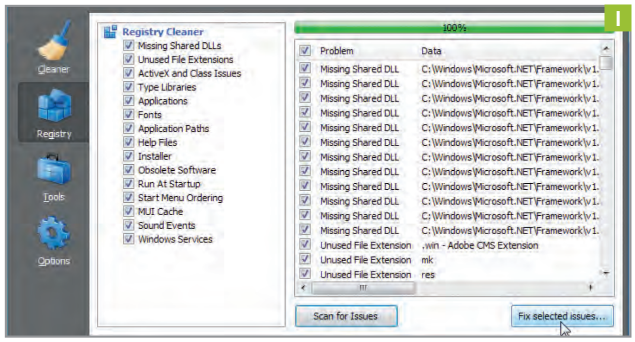
1 RUN A BASIC SCAN You'll find the latest version of CCleaner at www.piriform.com/ccleaner. Click Download, then choose one of the links in the Free section. You'll be taken to an external site where you can click a link to download the software. Once it's downloaded, select Run or Open. Click Next > Install and select Finish. The software should now start downloading automatically.

» CCleaner will also launch automatically. Click Yes for an "Intelligent scan" and you'll be presented with the main Cleaner screen. This will remove temporary files, delete Internet cookies, and empty the recycle bin, all of which can free up lots of space on your computer. Click Analyze to see what's going to be removed (**image H**), then select Run Cleaner when you're ready.

» CCleaner will now trawl through your computer and remove lots of unnecessary files. This may take a little while, and it might prompt you to close programs so it can purge them of useless stuff. When it's complete, you'll be able to see details of the files CCleaner has deleted, as well as the total space it freed up. To proceed with the process, click Registry.

» The registry contains all the little bits of information about your computer that programs need to work, but it can also fill up with unnecessary data. Click "Scan for Issues" to see the bits and bobs that CCleaner finds, followed by "Fix selected issues" to remove them (**image I**). Click Yes, when prompted, to back up these changes, then select "Fix All Selected Issues" to begin the cleanse.



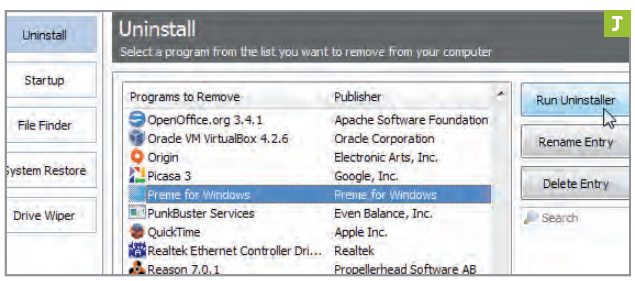


2 MANUAL CLEANUP Click Close once the registry's been tidied up, then select Tools > Uninstall. This handy list includes all the programs currently installed on your PC. Scroll through it, keeping an eye out for programs you no longer use. If you find any, click the entry and click Run Uninstaller to the right (**image J**) and follow the instructions to remove the program.

» In the Startup area, you'll find the programs Windows loads at boot. Having a program launch automatically can save you time, but it can also slow things down considerably. It's not a good idea to disable all of them, but if you recognize any programs you don't need on a daily basis (e.g., iTunes or Spotify) click each entry and select Disable.

» Once you've finished the CCleaner process, it's a good idea to reboot your PC. If CCleaner has done its job, your PC should be noticeably swifter, but if you do encounter any errors, simply return to the Startup menu and reactivate all disabled programs.

» Congratulations! You now know how to install CCleaner and use it to optimize your PC or laptop. It's a good idea to run it every now and then to keep on top of the files Windows is so keen on depositing everywhere—you can even run it on the computers of friends and family, too. With the help of CCleaner, you can keep even the oldest of PCs running like new.



BUILD IT

TOM MCNAMARA **ASSOCIATE EDITOR**



Spotlight on the Radeon HD 7990

We give AMD's 7000-series video card an honorable discharge from the GPU wars

LENGTH OF TIME: **2–4 HOURS** | LEVEL OF DIFFICULTY: **MEDIUM**

THE MISSION The ongoing war between Nvidia and AMD for supremacy over the PC gaming landscape has been like the Hatfields and the McCoys of enthusiast computing: long, bitter, and deeply entrenched. AMD's Radeon HD 7990 is the company's biggest salvo yet, combining two HD 7970 GPUs onto one card. It didn't come out until spring 2013, though, which was long after Nvidia's own dual-GPU behemoth, the GeForce GTX 690, had dug in its heels. And it wasn't until midsummer that AMD began to address the stuttering issues that marred its multi-GPU setups. With AMD's R9 series arriving in October 2013, this crown jewel didn't really have much time to shine. Today, we'll try and change that, pitting this Cadillac of a card against nothing less than Battlefield 4, with everything maxed out and running at 1920x1080. With the previous Battlefield regularly favoring Nvidia cards, this might seems like enemy territory. But this time, AMD is working closely with the developer to make sure nothing goes awry. And in December, BF4 will be the first game to feature Mantle, which AMD has positioned to replace Microsoft's DirectX API. In the end, the HD 7990 could set the bar.



GATHERING THE TROOPS

WE'RE NOT WORKING with a tight budget this time, so our roughly $750 video card will have some appropriately fancy company. With two 8-pin power connections, the 7990 draws a lot of juice, so that's our first consideration. We went with an 800-watt Cooler Master Silent Pro Gold. As its name indicates, it's a "gold"-rated PSU, so it will work efficiently, and it has some other nice features that we'll get into later. We also wanted a nice motherboard and CPU that could handle all the bandwidth that a dual-GPU card needs—that led us to the Asus X79 Deluxe and a Core i7-4960X. This is the LGA2011 platform, which gives us up to 40 PCI Express lanes, while LGA1150 boasts just 16 lanes. Since LGA2011 uses quad-band memory architecture, we'll be using four sticks of RAM. That's not critical for gaming, but the extra bandwidth is great for video encoding. For storage, we have a speedy 240GB SanDisk Extreme II SSD to boot with and run games from, and a 3TB Seagate Barracuda for media storage.

Our favorite item, though, has to be the case in which everything gets crammed. That would be the Silverstone FT04 mid-tower. It's not the easiest case we've ever worked with, but the end result is pretty cool, in more ways than one. You've probably noticed that the picture on the opposite page appears to be reversed. That's not an optical illusion. The inside of the case was designed on Opposite Day, and that has some neat side effects that we'll dig into soon.

INGREDIENTS

	PART	PRICE
Case	Silverstone FT04	$230
PSU	Cooler Master Silent Pro Gold 800W	$160
Mobo	Asus X79 Deluxe	$350
CPU	Intel Core i7-4960X	$1,000 (street)
Cooler	Phanteks TC14PE	$80 (street)
GPU	AMD Radeon HD 7990	$550 (street)
RAM	4x 4GB Corsair Vengeance LP	$150 (street)
SSD	240GB SanDisk Extreme II	$225 (street)
Hard Drive	3TB Seagate Barracuda	$135 (street)
Optical Drive	Samsung SH-S223	$15 (street)
OS	Windows 8 64-bit OEM	$90 (street)
TOTAL		$2,985

1 THE GUEST OF HONOR

THE HD 7990 is about 12 inches long, so it's not for the faint-hearted builder. Our case officially has 13.3 inches of room, so it'll work. We wanted to use the case's bundled VGA bracket, which prevents the card from sagging, but it obstructed our jumbo CPU cooler. Fortunately, the HD 7990 has a metal backplate to keep it from bending, so the bracket's not critical. (Water-cooling the CPU would allow use of the bracket). The card needs two 8-pin cables, which can be challenging to route in a traditional case layout, but here the power supply is installed right above the card, in the top of the case, so the cables don't need to do anything complicated to supply juice.



2 POWER TO THE TOWER

THE TOP OF THE case is no longer a common location for a power supply, but Silverstone is shaking things up. In ye olden days, the practice fell out of favor, as PSUs ended up sucking in heat rising off the CPU cooler and the video card, which was bad for long-term reliability. In the FT04, however, the power supply has a meshed vent right above it to aid cooling. Just remove a few thumbscrews in the back to slide off the case top and get the PSU inside. The top of the case has a built-in bracket to support the PSU's weight. Minimal heat comes off the GPU right below because the intake fans have been reversed, since the motherboard is flipped. The overall thermal design is much improved from earlier implementations. The side panels has tabs on the back that overlap with the top panel, so you have to remove the sides before taking off the top, then do the same in reverse.



3 FEATURES FOR CREATURES

THE X79 DELUXE (not to be confused with the older P9X79 Deluxe) has a number of interesting features. We like the beefy voltage regulators, integrated dual-band 802.11ac Wi-Fi, Bluetooth 4.0, eight SATA 6Gb/s ports, DTS audio, push-button USB-based BIOS updates, and even dual LAN ports and a stainless-steel I/O plate (pictured). The black-and-gold theme is also rather pimp. As an added bonus, the board recognized our Ivy Bridge-E CPU right away. This Intel chip is not a huge upgrade from the Core i7-3960X, but it performs moderately faster and generates a lot less heat. It's a hexa-core chip with Hyper-Threading. Games don't usually make much use of HT, but Battlefield 4 hungrily chews up every available processing thread. So it's nice to have 12.



4 THE DRIVE TO SURVIVE

ORDINARILY, THERE isn't a whole lot to say about installing a couple of storage devices in your average case, but the FT04 is anything but average. It has two cages at the bottom and one large cage in the front, all of which are removable. On the bottom, one cage gets an integrated SATA and power-connection bracket, while the other has a mini-jack for holding up a large air cooler. We said, "por qué no los dos," and put the bracket and the jack on the same cage, since we didn't need both cages. The FT04 has mounts for screwing up to four SSDs directly into the bottom of the case anyway, so the extra container would just take up space. To remove it, you lay the FT04 on its side and remove the cage screws from underneath, five in all. Being able to remove the screws from within the case is easier, but this will do in a pinch.



5 AIR TO THE THRONE

YOU MAY WONDER why we went with an air cooler in this system, since we're not really holding back in other areas. There are two reasons. One, we wanted to check out the case's built-in heatsink kickstand. It was just too neat of a widget to discard. Two, the FT04 doesn't have many case fan mounts. To put a 240mm radiator in the front, you have to remove two 180mm "Penetrator" fans, which are cool-looking and pre-connected to independent fan controllers. It seemed a shame to take those out of the picture, because they create some excellent airflow while keeping noise levels down. (In fact, the entire case is layered with sound-absorbing foam panels.) Since there are no fan mounts on the top, sides, or bottom, the only other alternative would be the 120mm mount in the rear, which we're already using as an exhaust port. We'd have to replace that with a radiator and fan, blowing outward. Not as thermally efficient as an intake, but you don't have much choice.



Regardless, we opted for air. The FT04 does not ship with a rear fan, so we pulled our Scythe Gentle Typhoon from a box of Dream Machine parts. Waste not, want not.

6 CABLE COMMENTARY

LIKE THE FRACTAL Design Define R4, the Silverstone FT04 is a wide case for its mid-tower form factor, so we have a lot of room to route cables behind the motherboard tray. Some excess power supply cabling can be tucked in the top of the case, as well. We needed the full length of the PSU's 8-pin CPU power cable, but we had overly long cables elsewhere. We used a piece of tape to secure the wiring of the Scythe Gentle Typhoon fan because its cabling is surprisingly stiff and prone to popping out otherwise. A pre-installed sleeve would be nice, considering the relatively high cost of this fan. The Silent Pro Gold's cables are flat and very flexible, so we had no trouble connecting them to the HD 7990 in a presentable way.





1. The FT04 is designed to be a sound-absorbing case, but that effect can be canceled out if you have a loud power supply located at the top.

2. You'll have to flip the case and screw the SSD directly into the underside.

3. An air cooler that uses 120mm fans would be small enough to not block the VGA bracket, but the TC14PE uses 140mm fans.

4. A series of holes in the rear of the frame allows you to manage the screws in the PCI slots without needing to angle your screwdriver.

INTO THE FRAY

ONCE WE GOT the system up and running, it was pretty smooth sailing. We had the 13.11 beta Catalyst drivers for the video card, and we were able to keep Battlefield 4 solidly at 60fps at 1080p, with all visual effects cranked to max settings. There were occasional dips into the single digits, but this could be the result of network congestion or unfinished optimization (we were playing the beta version of the game as this issue went to press; and the Mantle version of BF4, which replaces DirectX, is not scheduled for release until mid-December, so we can't test that yet.)

Also of note, BF4 seems happy to take as many CPU processing threads as you can give it, including Hyper-Threading (HT). Six appears to be the magic number; less than that, and the cores get pegged at 100 percent utilization.

In addition to this system, we also tried the game on a Core i5-4670K system with dual GeForce GTX 770s, an i7-4770K system with a single GTX Titan, and an AMD FX-8350 system with dual GTX 780s, and then the HD 7990. Enabling HT bumped up performance about 10 percent. However, the FX-8350 could not hit 60fps even with the HD 7990, while an i7 with Hyper-Threading disabled stayed comfortably above that mark when using a GTX 780. Like we said, the game was in a beta state as this issue went to press, so some performance optimizations may have arrived by the time you read this. But right now, the gap between Intel and AMD CPUs is consistent and noticeable (although Premiere Pro spat out some odd results, despite repeated tests).

Temperature-wise, dual 180mm intake fans bring in a lot of external air, and the Lab is temperature-controlled around 70 degrees F. Leaving a single 120mm fan to remove heat didn't seem to be a problem, though the Gentle Typhoon is admittedly very good at air displacement. Still, it seems like a $230 case should offer more options. The top has an intake for the power supply, and it looks like there's plenty of room for a fan mount up there, as well. The similarly priced Thermaltake Level 10 GT has a 230mm fan in the top and on the side, and a bonus mount on the bottom of the case. Of course, its aesthetics are much different. The FT04 is obviously designed to look sleek. But it may sacrifice too much in the process.

Nevertheless, this build felt like a success. We got the performance we wanted, and the system felt very solid and stable. It was also fun to see a game use more than four CPU cores.

BENCHMARKS

	ZERO POINT	
Premiere Pro CS6 (sec)	2,000	2,020 (-1%)
Stitch.Efx 2.0 (sec)	831	744
ProShow Producer 5.0 (sec)	1,446	1,309
x264 HD 5.0 (fps)	21.1	24.2
Batman: Arkham City (fps)	76	93
3DMark11 Extreme	5,847	5,684 (-3%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

The zero-point machine compared here consists of a 3.2GHz Core i7-3930K and 16GB of Corsair DDR3/1600 on an Asus P9X79 Deluxe motherboard. It has a GeForce GTX 690, a Corsair Neutron GTX SSD, and 64-bit Windows 7 Professional.

REVIEWS

TESTED. REVIEWED. VERDICTIZED.

INSIDE



V3 DEVASTATOR PAGE 76



The Devastator fits in a pair of GeForce GTX 770 cards along with a new Haswell chip.

V3 Devastator

Pint-size PC packs a punch

HOW MUCH PC power can one jam into a bread box? (We'll take a commercial break while the youngsters Google "bread box.") V3 Gaming tries to answer that question with the latest iteration of its Devastator small form factor box. Unlike the four micro-towers that we reviewed in our November 2013 issue, the Devastator conforms to a boxier silhouette, using a slick new Silverstone SG10 case.

The SG10 is slightly taller than a traditional SFF box, so it can accommodate a microATX motherboard. Lest you wonder why you'd need a microATX in an SFF, we have a simple answer: multiple video cards—more on that later.

The Devastator seems like it was configured with best-bang-for-the-buck in mind. Inside, you'll find a pair of GeForce GTX 770 cards slotted into the Asus Gryphon Z87 board, 16GB of Corsair DDR3/1600, and a Core i5-4670K clocked up to 4.4GHz. For storage, V3 Gaming didn't skimp on the primary drive—something a lot of vendors do these days—and outfitted the Devastator with a 256GB Plextor M5 Pro SSD. Bulk storage, however, is a bit paltry, consisting of a 1TB Toshiba desktop HDD. These days, it's pretty hard to justify a 1TB drive on a build that costs more than $800.

To measure the Devastator's performance, we looked to three points of comparison. First was our aging Sandy Bridge-E zero-point test bed, where it was a give-and-take contest. In thread-light tasks, the Devastator's higher-clocked Haswell is on par and even sometimes faster than the six-core SNB-E in our zero-point. Flip to, say, Premiere Pro CS6 or x264 HD 5.01 encoding, however, and even the elderly Sandy Bridge-E cores hammer the hell out of the less-threaded Haswell. In gaming, the tide turns yet again, with the once-mighty GeForce GTX 690 in our zero-point being trounced by the Devastator's pair of GeForce GTX 770 cards. Boo hoo.

Next, we looked to the four micro-towers we reviewed in November. The $2,000 iBuypower Revolt with its stock-clocked Core i7-4770K and single GeForce GTX Titan actually ties the Devastator in x264 HD 5.0 and Stitch.Efx 2.0, but loses by 7 percent in ProShow Producer. The Mighty Titan is also bested by the pair of GeForce GTX 770s in 3DMark 11 by roughly 34 percent. Where the Revolt comes back is in Premiere Pro CS6, where Hyper-Threading gives it a double-digit advantage in rendering.

But that's not the whole story on micro-towers. We also pit the Devastator against the $4,433 Falcon Northwest Tiki, and the latter's 4.7GHz Core i7-4770K simply dominated in the compute-heavy tasks. But, again, the Tiki's Titan can't compete with the dual GeForce GTX 770s—the Devastator is faster in 3DMark 11 by 22 percent. The gap closes in 3DMark Fire Strike Extreme, where the Devastator is but 10 percent faster.

The Tiki is an extreme example, though. For the most part, simple physics and the ability of a bigger box to better displace thermals and hold more hardware put standard desktops at an advantage. For example, the $2,000 CyberPower Zeus Evo Thunder 3000 SE that we reviewed in our September 2013 issue aces the Devastator in compute tasks, thanks to its Core i7-4770K, and comes out slightly faster in gaming since it also has a pair of 770s, while coming in $500 cheaper. Of course, it's also much bigger.

Still, the Devastator is a good blend of size and performance, and is fairly priced to boot, given that small form factor boxes typically carry a premium. –GORDON MAH UNG

VERDICT 8

V3 Devastator

+ STAR DESTROYER Well-balanced small form factor box.

− STAR SEARCH Have to fight the case to close; HDD a tad small.

$2,500, www.v3gamingpc.com

BENCHMARKS

	ZERO POINT	
Premiere Pro CS6 (sec)	2,000	2,978 (-33%)
Stitch.Efx 2.0 (sec)	831	826
ProShow Producer 5.0 (sec)	1,446	1,336
x264 HD 5.0 (fps)	21.1	16.6 (-21%)
Batman: Arkham City (fps)	76	97
3DMark 11	5,847	6,590

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a hexa-core 3.8GHz Core i7-3930K and 8GB of Corsair DDR3/1600 on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

SPECIFICATIONS

Processor	Intel Core i5-4670K @ 4.4GHz
Mobo	Asus Gryphon Z87
RAM	16GB Corsair Vengeance DDR3/1600
Graphics card	2x GeForce GTX 770 in SLI
Sound card	Onboard
Storage	256GB Plextor M5 Pro SSD, 1TB Toshiba HDD
Optical	8x DVD burner
Case/PSU	Silverstone SG10 / Corsair 750W PSU



The R9 280X is a heck of a lot more quiet and affordable than the original HD 7970 GE.

Asus Radeon R9 280X DC2 TOP

The new 1080p king

AT ANY GIVEN time, we have one GPU in our inventory that holds the title of "loudest card in the office." The current title-holder is the PowerColor Radeon HD 7970 Vortex, which sounds like a jet engine. That's just how the Radeon 7970 GHz cards are; their boosted clock speeds drum up a lot of heat, making them much louder than their Nvidia counterparts. Given this pedigree, imagine our surprise when we fired up the Asus Radeon R9 280X, which rocks the exact same Tahiti XT chip used in the 7970 GE boards. As we leaned in close to our test bed expecting to hear that oh-so-familiar fan noise, we were greeted instead with a barely audible whirring sound. It's truly miraculous what AMD and Asus have done with this formerly unruly chip, making it whisper-quiet and also surprisingly affordable at $310, which is roughly half what it used to cost.

Like the previous Asus boards we've reviewed, this is a DirectCU II card, so it has a fancy custom PCB, high-end components for improved stability, longevity, and overclocking, as well as a hulking two-slot cooler we've seen before (and loved). This is a 28nm Tahiti card, with 2,048 stream processors, a 384-bit-wide memory bus, and 3GB of GDDR5 memory. This card will be competing with the more expensive Nvidia GTX 770, which costs $400 as we went to press, with no indication that Nvidia will lower its price. Perhaps after reviews of this card appear, Nvidia will rethink that proposition.

This is a TOP card, which means it's overclocked, but not by much at 1,070MHz, only 70MHz higher than stock. Asus also has a super-premium version of this card named the Matrix Platinum, which has a three-slot cooler and a much higher price tag. One interesting note is that, unlike the flagship R9 290X cards with their new dies that don't require a CrossFire bridge, this card still requires a bridge in multicard configs. Thankfully, Asus threw a bridge connector into the box along with a driver CD. The card measures 11 inches long and includes two DVI connectors, one HDMI, and one DisplayPort connector.

When we ran the R9 280X through our gauntlet of PC benchmarks, two things immediately surprised us. The first was just how quiet the card was, as it is barely audible at any time, even under heavy load. The second was that it was trading blows with the GTX 770, which costs $90 more. Sure, the GK104 and Tahiti chips have always been comparable, so this is expected, we suppose, but given this card's low pricing (by comparison), it was hard to wrap our heads around the fact that it's punching above its weight class. It also handily spanked the $250 GTX 760, giving it the best price-to-performance ratio in its price segment.

In the end, this is the go-to card for ultra settings at 1080p, no question. It smokes the more expensive GTX 770 and also spanks the GTX 760, as it should. If the performance delta isn't enough to sway you, there's word that the Never Settle Forever game bundle will be coming to the 200-series cards soon, too, making this card almost irresistible. The only fly in the ointment is the Asus GPU Tweak software, which looks and feels antiquated, and is difficult to examine at a glance. Thankfully, third-party options are available, making this only a minor blemish on an otherwise perfect GPU.

–JOSH NOREM



BENCHMARKS

	Asus Radeon R9 280X DC2T	GTX 770 (Reference)	GTX 760 (Reference)
Driver	13.11	327.33	327.33
3DMark Fire Strike	**7,853**	6,965	5,715
Unigine Heaven 4.0 (fps)	43	**44**	35
Unigine Valley (fps)	62	**63**	53
Crysis 3 (fps)	**39**	37	32
Far Cry 3 (fps)	**48**	46	39
Tomb Raider (fps)	27	**30**	23
Metro: Last Light (fps)	24	**29**	18
Battlefield 3 (fps)	**46**	38	32

Best scores are bolded. Our test bed is a 3.33GHz Core i7-3960X Extreme Edition in an Asus P9X79 motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 7 Ultimate. All tests are run at 1920x1080 with 4X AA except for the 3DMark tests.

VERDICT 9 KICK ASS!

Asus Radeon R9 280X DC2 TOP

➕ **TAHITI** Very fast; silent; aggressively priced; includes CF bridge.

➖ **DRYGALSKI ISLAND** GPU Tweak software is meh.

$310, www.asus.com



The fans have small embossed arrows to indicate airflow.

Cooler Master V8 GTS

Not firing on all cylinders

WHEN IT COMES to keeping your CPU cool under pressure, it's hard to beat a closed-loop liquid cooler (CLC). They're on the expensive side, though, so there's still plenty of room at $50 and below for conventional air cooling. What, then, do we make of an air cooler with an MSRP of $100? It's gotta be pretty fancy to command that kind of scratch, and the Cooler Master V8 GTS sure seems like a contender.

As its name suggests, it's an update of the original V8, which used a single 120mm fan to cool four sets of radiator fins. That version is actually still compatible with recent CPU sockets, but it's rated for "only" 180 watts of heat dissipation. The GTS version ups the cap to 250 watts, with dual 140mm fans and a vapor chamber. But despite its bulk, it will still play nice with high-profile RAM sticks and large motherboard heatsinks, such as those on the Rampage IV Extreme in our test-bench machine.

However, the fans are not designed to be removed, making installation a bit awkward. You know that things are not going to go swimmingly when the bundled items include a proprietary tool for tightening nuts. And sure enough, we had to pull the RAM, video card, and motherboard from the case to get enough clearance to crank this widget. This is also a four-way SLI motherboard, so the first slot is designed for the primary video card. But unfortunately, there was not enough space there to install it. We can just use a different slot in our test system, but you may run into trouble if you're already using your slots for other devices.

You might let these hassles slide if the cooler had the class-leading performance to justify its quirks. Unfortunately, our testing demonstrated that the V8 GTS was good, but not $100 good. The Phanteks TC14PE cools a little more, costs less, and is quieter and a lot easier to install. Cooler Master's own Hyper 212 Evo air cooler edges out the GTS for nearly a third of the price, albeit at unacceptable noise levels (never mind the CLCs from NZXT and Corsair that cost about the same as the V8 GTS and considerably outperform it).

The GTS's aesthetics may win over some converts, though. A silver-and-black theme rarely fails to deliver, and an overall shape evoking a V8 engine block is admittedly pretty nifty. The fans also sport several red LEDs, slotted in the top to make it look a bit like a Decepticon. More LEDs are tucked underneath, so they can't be seen directly but emit a spooky glow onto the motherboard.

But that silvery look comes at a cost; the GTS's heat pipes and contact surface are aluminum instead of copper, which can make a difference when dealing with this much surface area; copper tends to transfer heat more quickly, but it's also heavier and more expensive. It's also disappointing that the fans will be tricky to replace if they break down, get damaged, or aren't beefy enough for your needs. They use a custom housing similar to a Noctua NF-P14, but with two screw holes removed.

The V8 GTS isn't a complete indictment of performance air coolers, but we're wondering if that time isn't fast approaching. –**TOM MCNAMARA**

VERDICT 7

Cooler Master V8 GTS

+ SUPERMAN Sleek looks; plays well with high-profile RAM.

– BIZARRO Tedious installation; blocks card slot; underwhelming price-to-performance.

$100, www.coolermaster-usa.com

BENCHMARKS

	Cooler Master V8 GTS Quiet / Performance Mode	Cooler Master 212 Evo Quiet / Performance Mode	Phanteks TC14PE Quiet / Performance Mode	Corsair H100i Quiet / Performance Mode
Ambient Air	21 / 21.3	20.5 / 20	20 / 19.9	20.3 / 20.5
Idle Temperature	36.8 / 30.8	35.5 / 30.5	32 / **28.5**	**30.7** / 29.3
Load Temperature	73.2 / 71	70 / 67.3	70.3 / 68.6	**67.1 / 61**
Load - Ambient	50.2 / 49.7	49.5 / 47.3	50.3 / 48.7	**46.8 / 40.5**

Best scores bolded. All temperatures in degrees Celsius. All tests performed with an Intel Core i7-3960X at 4.1GHz, on an Asus Rampage IV Extreme motherboard, in a Corsair 900D with stock fans set to Standard.

SPECIFICATIONS

Heatsink Dimensions (H x D x W)	6.1 x 5.9 x 6.6 inches
Weight	2.6 lbs
Stock Fans	2x 14cm 4-pin
Socket Support	LGA1150/1155/1156/1366/2011; AM2/AM2+/AM3/AM3+/FM1/FM2
Additional Fan Support	None



We don't like the Envoy Pro's Mac-esque looks.

Solid-State Shenanigans

Three wild and flashy drives

Solid-state flash and DRAM used to exist solely in expensive luxury items, but now that prices have come down it's starting to pop up all over the place, and we're stoked about that. Rotating media just plain sucks, both in terms of speed and durability, so we welcome our new solid-state overlords. This month, we collected three curious devices that use flash or DRAM in new or different ways, not to compare them, but to give you a taste of what's out there. –CLARK CRISP AND JOSH NOREM

OWC ENVOY PRO EX 240GB

The OWC Envoy Pro EX is part of a new breed of portable storage devices that ditch mechanical hard drives in favor of solid-state drives connected to a USB 3.0 port. They offer a massive improvement in speed and durability at the cost of, well, cost. They are expensive, with a gigabyte-to-dollar ratio that exceeds what we see with standard desktop SSDs. As an example, a high-performance 2.5-inch SSD costs just a bit less than $1 per gigabyte, but this OWC drive offers 240GB and costs $315, or $1.30 per gigabyte.

In exchange for all that cheddar, you get a 240GB OWC Aura Pro 6G mSATA SSD drive wrapped in an anodized aluminum body, and it pulls all its power from the USB 3.0 connector. The drive is offered in both 240GB and 480GB capacities, and comes with a three-year warranty. It's 4.5 inches long, two inches wide, and just half an inch tall, and since it has no moving parts it can be tossed around the Lab like an intern.

The mSATA drive inside was originally developed as a replacement part for the unit in the 2012 MacBook Air, so it's a tiny bit long in the tooth, and the fact that it uses a SandForce SF-2281 controller confirms its old age. We do like that is uses synchronous MLC NAND, though, which is the good stuff. The drive is rated for 500MB/s read and write speeds, and 60K IOPS, which are decent specs but not top-of-the-charts. One oddity: The manual says this drive is not compatible with USB 2.0, which could cause major issues for some people. Luckily, we experienced no issues with USB 2.0 in our testing.

Speaking of our tests, the drive was decidedly average, falling in below the fastest SSDs we've tested, and also somewhat below its own rated specs. We were able to squeeze 428MB/s out of it in sequential-read speed tests, but just 305MB/s in sequential-write tests. Those speeds aren't too shabby, but, again, not exactly mind-blowing. Still, that's three times what we see with a USB 3.0 5,400rpm HDD, so it's safe to call it the fastest portable storage we've tested yet. Too bad it's so expensive. Buy a $20 2.5-inch USB 3.0 enclosure and a $200 Samsung 840 Evo and you'll be better off.

VERDICT 7

OWC Envoy Pro EX 240GB

$315, www.macsales.com

SUPER TALENT DRAM DISK

When we first heard of this USB DRAM disk, we didn't really know what it was, but we knew we wanted to try it out. Now that we've had a chance to kick the tires, we're impressed, even though it's not the most practical thing in the world. Then again, acquiring maximum performance is rarely practical, yet it's still our *raison d'être*. The DRAM Disk is a USB 3.0 thumb drive available in 8GB, 16GB, and 32GB capacities and includes software to create a RAM disk. It works quite well, though the key itself features a boring design.

The way this bad boy works is, when you plug in the drive there are two volumes—the main USB 3.0 drive, and a second volume that appears like a CD/DVD to the system and contains the RAM disk software and a user guide. Once you install the software, which takes five seconds, a new volume appears, and that's your RAM disk. Whatever you copy into the RAM Disk folder is also synced in the background to a folder on the USB key, which is handy but it also demonstrates the problem with RAM disks. Since they use volatile DRAM, as soon as the system loses power, everything on them is delet-

The Buffalo DriveStation packs a gig of NOS-like DRAM for boosted speed.





Software on the DRAM Disk lets you create a RAM disk, which then syncs to the key in the background.

ed, so it's inherently unsafe to keep data on them without a backup—one accidental reboot or Windows update and all your data goes sigh-oh-narr-ah.

On our test system with 8GB of RAM, the RAM disk was 2.90GB, though we could have made it smaller via the included software. Adding another 4GB of RAM increased the size of the RAM disk by 1.4GB. The RAM disk itself is insanely fast, hitting 5GB/s read speeds and 8GB/s write speeds in CrystalDiskMark. You can copy gigs of data in a millisecond, and it's truly breathtaking to witness. The USB 3.0 portion of the key is standard stuff, running at about 100MB/s in our transfer tests, so you could use it like a standard-issue key if you want to.

Overall, we dig the DRAM Disk. It makes it quick and painless to run a RAM disk, which provides insane speed for scratch disks and other temporary files. It works exactly as advertised and is totally affordable too, costing just $15. We think it's pretty sweet, but are withholding the Kick Ass, as it needs more capacity and a better chassis design.

VERDICT 9

Super Talent DRAM Disk

$15 (16GB), www.dramdisk.com

BUFFALO DRIVESTATION DDR

Buffalo's DriveStation DDR is a unique USB 3.0 enclosure with a 2TB HDD and a gigabyte of DRAM as a buffer to help boost performance. It works too, making it the fastest external drive we've ever tested. Buffalo also includes several utilities called Buffalo Tools that allow for scheduled backups, creation of a RAM disk, data encryption, and password protection.

The DriveStation has a familiar form factor and weighs 2.2 pounds. It comes with a decent three-year warranty and is offered in either 2TB or 3TB capacity. Since it's rocking a 5,400rpm hard drive, it does require active cooling, but stays nice and quiet and never got more than warm to the touch in testing. The enclosure also features an LED indicator for when the DRAM is being accessed, and the geek in us enjoyed seeing it light up.

Buffalo's bundled software suite offers five utilities to create backups for multiple computers, protect files and data with 256-bit AES encryption, make a RAM disk for ultra-fast file access, schedule sleep mode to reduce energy consumption, and to password-protect the drive itself. You can even set the maximum amount of password attempts before the drive locks out the user. Overall, the bundle is perfect, and has everything a power user could want.

In Lab testing, the DriveStation delivered wicked-fast speeds. In CrystalDiskMark, we saw sequential read and write speeds of 300MB/s and 329MB/s, respectively. For comparison, Western Digital's My Passport USB 3.0 drive only squeezed out 98MB/s read and 97MB/s write speeds, meaning the Buffalo drive is roughly three times faster. The gig of DRAM on the DriveStation really works, so thumb's up to Buffalo for being the first manufacturer to incorporate this type of memory into a backup solution.

As far as backup drives go, the DriveStation is at the top of its class and we were impressed with its performance. However, you gotta pay to play, and its $150 price tag is about twice as high as a WD My Book. However, that extra cash gets you a lot of speed, a fantastic software bundle, and one Kick Ass device.

VERDICT 9 KICK ASS!

Buffalo DriveStation DDR 2TB

$150, www.buffalotech.com



Despite its netbook looks and pricing, the C710-2457 runs a Sandy Bridge Celeron and the Chrome OS.

Acer Chromebook C710-2457

The latest in web-based computing brings low cost and better performance

GAME OF THRONES fans jonesing for their fix of political intrigue, back-stabbing, and disloyalty don't have to wait for a new season. It's happening right now on the PC, just without the full-frontal nudity and British accents.

PC OEMs, who once all rallied under the banner of Microsoft, are no longer content to accept orders from King's Landing, err, Redmond anymore. No, instead, we're seeing dissent as more and more makers have begun releasing laptops running Chrome OS.

What caused the fracture in the Seven Kingdoms? It's not known, but we suspect Microsoft's decision to produce its own PCs didn't help. The Kingdom of Acer was one of the first traditional PC OEMs to announce a Chromebook.

The Chromebook you see here, in fact, is the company's second effort. It's a serious upgrade over the original Atom-based AC700 line and sports a Sandy Bridge Celeron 847, a 16GB SSD, a 1366x768 monitor, and a Fast Ethernet port along with HDMI, VGA, and an SD card reader. The unit is a bit thick, the power brick is fugly, and the page up, page down, and power buttons are user-hostile, but in the plus column, the internals are easily accessible. You won't be doing too much inside there, however. The machine is already maxed out at 4GB of RAM in two accessible SO-DIMM slots. The only real "upgrade" would be swapping out the 16GB SSD, and that kind of goes against the whole principle of a Chromebook.

The Acer C710-2457 looks and feels like a netbook, but it's not running Windows—it's running Chrome OS. Chrome OS is based on lightweight Linux and runs halfway decently even on older, anemic Atom CPUs. Running on the Acer C710-2457's 1.1GHz Celeron, the Chrome OS feels downright snappy. Certainly not as snappy as on Google's own Ivy Bridge–based Pixel, but way better than on any Atom Chromebook we've touched. To see how the Acer C710-2457 stacks up against its peers, we ran several browser-based benchmarks on Samsung's ARM-based Chromebook and the Google Pixel, as well as Google's OG reference Chromebook, the CR-48.

In performance, the 1.1GHz Celeron 847 pretty much trounces the 1.7GHz Exynos 5 ARM chip. Of course, the Pixel destroyed all comers—no surprise—but again, it's a $1,300 Chromebook versus the $230 ($200 street) Acer C710-2457. Chromebook users still rolling Atom should really think about bailing—our CR-48 results show you just how woefully inadequate these units are, even with COS.

In an overall competition between the comparably priced Acer C710-2457 and ARM-based Samsung, we're a little torn. We prefer the Samsung's keyboard and form factor, as well as its anti-glare screen, but the Acer has the performance advantage. In run time, the Samsung took the win, with almost an hour and a half longer battery life than the Acer, using the Futuremark Peacekeeper benchmark in a continuous loop.

Hence our equivocation: With the Acer, you get perhaps 20–40 percent better performance; with the Samsung, you're getting more than 40 percent better life. It's not that the Acer's battery life is bad, but it's not stellar either. We'll also point out that battery rundown tests are always usage-dependent, and sitting there pecking in an email or reading a web page should yield longer run times than the CPU-intensive Futuremark test.

We hate to say it, but that means you'll have to decide on your own—good battery life and average performance vs. average battery life and good performance (at least for Chrome OS). –GORDON MAH UNG

BENCHMARKS

	Acer C710-2457	Samsung Chromebook	Google Pixel	Google CR-48
CPU	Dual-core 1.1GHz Celeron 847 Sandy Bridge	Dual-core 1.7GHz Samsung Exynos 5	Dual-core 1.8GHz Core i5 Ivy Bridge	Single-core + HT 1.66GHz Intel Atom N455
GPU	Intel HD Graphics	Samsung Mali-T604	Intel HD4000	Intel GMA3150
Browser Version	29.0.1547.70	29.0.1547.70	29.01547.70	29.0.1547.70
SunSpider JavaScript 0.9.1 (ms)	570	698.9	**342.2**	1,578
Google Octane V1	5,832	5,050	**9,528**	2,551
Futuremark Peacekeeper	1,391	1,117	**2,492**	509
Browsermark 2.0	3,366	2,898	**4,258**	1,950
WebGL Solar System (fps)	20	28	**33**	2
Kraken 1.1 (ms)	4,337	5,099	**2,535.2**	11,976
Wirple	262	207	**880**	75
GUIMark 2 Pixel Stroke Test (fps)	26.62	28.38	**52.23**	15.93
GUIMark 2 Bitmap Game Test—HTML5 (fps)	49.91	36.07	**56.78**	12.53
GUIMark 2 Text Column Test —HTML5 (fps)	12.5	13.41	**18.86**	5.24
RoboHornet Alpha RH-A1 (fps)	66.97	57.55	**103.4**	31.48
Battery Rundown Test (min)	195	**283**	N/A	N/A

Best scores are bolded.

VERDICT 8

Acer Chromebook C710-2457

+ CHROME Trounces ARM and Atom in performance.

– TIN Average battery life; Hobbit-size power and cursor keys.

$230, www.acer.com



A button allows you to toggle the light behind the Gateway logo on and off. Fancy!

Gateway One ZX4970-UR22

A budget-friendly AiO for dad

WHILE WE love powerful super-rigs that can cut through benchmarks like a hot knife through buttah, not everyone can afford an $8,000 PC. This is where a budget-friendly all-in-one computer such as the Gateway One ZX4970 comes into play. At a mere $530, it certainly presents an interesting value proposition, but is it actually a good deal or a waste of dough?

The first thing you'll notice about the ZX4970 is its 21.5-inch screen. It's not small, but it is dwarfed by most other AiOs on the market, which generally come in 23- and 27-inch form factors. Furthermore, the display's TN panel offers subpar viewing angles, besides being a bit dim. But where the ZX4970 really falls short is in its omission of a touchscreen, which is a shame given the presence of the touch-friendly Windows 8 OS. On the upside, we don't have much beef with the integrated 2.5-watt speakers beneath the monitor—they serve decent volume levels, though they obviously can't match a dedicated 2.1 setup.

On the left side of the screen, the ZX4970 features two USB 3.0 ports, an SD card reader, and both a headphone and mic jack. To the right of the monitor is a button that lets you switch the AiO's HDMI port from in to out (or vice versa) and a DVD burner. The HDMI port itself resides behind the monitor, along with four USB 2.0 ports and an Ethernet jack. It's not an exorbitant amount of ports, but it covers most common needs. Cables can be routed through a cutout on the stand in the back. The stand allows you to bend the monitor back roughly 20 degrees, which could be useful for use from a standing position if not for the fact that the screen doesn't support touch and the included full-size keyboard and mouse are wired, so you're essentially tethered to your desk anyhow.

If you're hoping to play the latest PC games or put the machine through heavy compute tasks, the ZX4970 is not for you. While the AiO features a respectably hefty (for this price, that is) 1TB hard drive, the rest of the ZX4970's parts are pretty bare-bones. The unit is running a dual-core Ivy Bridge–based Intel Pentium G2030 clocked at 3GHz, has 4GB of DDR3/1600, and lacks discrete graphics. Compared to our Asus ET2300 zero-point AiO, which features a quad-core processor, twice the amount of RAM, and a GeForce GT 630M GPU, Gateway's offering faced a whole lot of pain in our benchmarks. It performed roughly 20–30 percent slower in our ProShow Producer 5 and Stitch.Efx CPU tests, and was left in the dust in x264 HD 5.0 benchmark, which thrives on cores. Our ZP AiO is by no means a tank, but compared to Gateway's ZX4970, it was like an M4 Sherman facing off with a Volkswagen microbus full of hippies. And as far as graphics go, high-end integrated graphics are on the cusp of matching low-end mobile GPUs, but the ZX4970 uses a meager Pentium integrated-graphics solution, so it found itself roughly 60–70 percent slower than the ZP's GeForce GT 630M in both the STALKER: CoP and Metro 2033 benchmarks. In our real-world test, we booted Borderlands 2 and ran everything on low at 1366x768 resolution and got an average frame rate in the mid-teens. No, it's notß pretty for anything beyond casual gaming.

While the ZX4970 is dang cheap, it's an unfortunate example of "you get what you pay for." It reminds us of the affordable eMachines of yesteryear, in AiO form. Although it may be a decent computer for Aunt Peg, for an enthusiast, we recommending spending a little more to build a much better desktop. –JIMMY THANG

VERDICT 6

Gateway One ZX4970-UR22

+ STAIRWAY TO HEAVEN Affordable and fairly priced.

– GATEWAY TO HELL No touchscreen; wired keyboard and mouse; relatively small screen; weak specs.

$530, www.gateway.com

BENCHMARKS

	ZERO POINT	
Stitch.Efx 2.0 (sec)	1,192	1,721 (-30.7%)
ProShow Producer 5 (sec)	1,841	2,365 (-22.2%)
x264 HD 5.0 (fps)	9.9	5 (-49.5%)
Metro 2033 (fps)	22	7.3 (-66.8%)
3DMark 11 Perf	1,333	367 (-72.5%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point all-in-one PC is an Asus ET2300 with a 3GHz Intel Core i5-3330M, 8GB DDR3/1600, 1TB 7,200rpm hard drive, a GeForce GT 630M, and Windows 8. Metro 2033 tested at 1280x768 with Medium settings, Tessellation enabled.

SPECIFICATIONS

CPU	3GHz Intel Pentium G2030
GPU	Intel HD Graphics 2500
RAM	4GB DDR3/1600 in single-channel
HDD	1TB (7,200rpm)
Optical	DVD burner
Display	21.5-inch LED backlit TN LCD 1920x1080 (matte)



The K95 ditches the too-bright blue LEDs from the K90 in favor of softer white lights.

Corsair Vengeance K95

Many small improvements, and some annoyances

THE CORSAIR VENGEANCE K95 keyboard is a refreshed version of the K90, which was itself an impressive enough plank to be part of the 2012 Dream Machine. There were those, however, who weren't completely satisfied with the K90. The biggest issue users noted was its hybrid construction: mechanical keys for its standard keyboard, with the much-hated membrane construction for its macro keys. Corsair has remedied this gripe with the K95, and has also tweaked the board's styling a bit. Though it still uses a sleek brushed-aluminum body, the K95's color has switched from silver to black, and the bright blue LEDs of its predecessor have been replaced with more subtle white ones, giving it a different look from the previous model while still hewing closely to the family's overall design.

The keys are fully replaceable, just like on the previous model; unfortunately, Corsair doesn't include a key-removal device as it does with the less-expensive K70 models. It also doesn't include special W-A-S-D keys with a different color and texture as it does on the K70, which is a bizarre oversight on a keyboard this expensive. You can control each key's lighting, though, which is slick, and this feature can be managed on the fly. A backlight toggle button adjusts the lighting by illuminating the entire keyboard or just the WASD, 1–6, and arrow keys, and you can also turn off the lighting altogether, or set it to one of three brightness levels. Furthermore, you can save up to three different lighting and macro presets using the M1, M2, and M3 keys on the upper-left of the keyboard. Setting them is as easy as pressing and holding the backlight programming key until it blinks red, then specifying the keys you want illuminated. The right side of the board contains easy-to-access media controls, just like on the K90.

The keys sit on Cherry MX Red switches, as with the previous model, making it extremely responsive whether you're updating your status or spamming spells in an MMO or MOBA. Most gamers like the MX Red switches because very little effort is required to depress the keys, but the keys need to be actuated all the way down to register a key press. MX Blue keys require just a half-press, making them better for typing, but they are also usually really loud and too twitchy for most gamers.

On the left side of the K95 plank there are a set of 18 programmable macro keys, aka the "G-key pad." The K90 sported this feature as well, but these weren't backlit and were the aforementioned membrane switches. Unfortunately, the close proximity to the Tab, Shift, and Ctrl keys make it possible to hit the wrong keys if you're not careful with your typing; it would be nice if Corsair made the G-key pad detachable. One other thing that bothered us is that the software needed to program the macro keys didn't come in the box, but had to be downloaded from Corsair's website. We have experienced this same issue with Corsair coolers, and it's always annoying.

Overall, this keyboard marks a modest improvement over the K90, with better features, more customization, and a more refined, professional look. We really like the changes, and think they were needed, but this board still falls just short of totally blowing us away due to its idiosyncrasies. It's a very solid day-to-day board, but as the soup Nazi says, "No Kick Ass award for you."

–**SAM WARD**

VERDICT 9

Corsair Vengeance K95

+ LEGOS Sturdy construction; customized per-key lighting; fully mechanical.

– MEGABLOCKS Tight macro-key spacing; no software CD or extra keys.

$150, www.corsair.com



Master the art of the air combo and you'll be nigh-unstoppable in Foul Play.


Foul Play does an excellently cute job of maintaining the game's "stage show" aspect.

Foul Play

Mash all the buttons

GOING FOR A spin or two in the indie title Foul Play takes us back to our youth. Specifically, a time before we had deep knowledge of fighting-game moves; a time when the fabled art of the button mash often proved successful against our lesser-equipped (grade-school) friends.

Foul Play slaps a decently creative premise over a genre classic: This game is a 2D, button-mashing, side-scrolling slugfest, pure and simple. So much so, that we'd almost prefer to play it on a handheld controller instead of our keyboard. While the game does an admirable job of straddling console and PC platforms with minimal frustration, it's pretty clear it was developed with consoles in mind. A quick, refreshing jaunt through one of the game's 22 separate "acts" feels like the kind of thing you'd do to relax while waiting for a friend to come over (obviously, to join you in some Foul Play co-op.)

The game's story isn't all that interesting, we admit: Set in an environment that's aesthetically reminiscent of *Gangs of New York*, you're a demon-hunter, retelling stories of your accomplishments through each of the game's five plays. That's right—plays. The intriguing bit of Foul Play is that the entire slugfest is set within the world of theater. You're not running through caves or climbing mountains, so much as you are acting out your exploits on stage—beating up actors costumed as baddies, throwing enemies through set pieces, and stringing together wicked fighting moves for approval by the ever-present audience that's watching the carnage unfold from the lower-half (or so) of the game's screen.

In fact, you don't even have a health bar. In this beat-'em-up, it's audience approval that dictates whether you "live" or "die," as it were. Dodge your way around a level and generally act boring, and you'll start to get booed (and ultimately have to restart your brawling from the last checkpoint); string together a 50-hit combo, and the crowd will throw their hats into the air with approval and your special move meter will start to shine like a Tony award.

Foul Play isn't itself all that challenging; we found ourselves rarely succumbing to any of the game's fights while rampaging through its three-to-four-hour storyline. What's challenging, however, are the game's... well, challenges. Within most of the game's levels, Foul Play gives you the optional task to accomplish three varying things. One might be something like, "achieve a 75-hit combo," or "throw three people into one another"—things like that.

These challenges are relatively achievable and, honestly, much-needed aspects of the core game given that the endless fighting does start to get a bit lukewarm after a while. However, we wish Foul Play's combo system was a bit more lenient; we often found ourselves losing our multi-hit combo—and our patience—simply because it took too long to jump to an enemy halfway across the screen. Boo, indeed.

Additionally, we wish the main character himself simply had more he could do. We'd much prefer a crazy amount of Arkham City–style combos, move-stringing, and general insanity versus Foul Play's simplified setup, which made us feel as if we were mashing the same button over, and over, and over—about as fun as it would be to play Street Fighter II and jab all the challengers to death.

Foul Play is cute, fun, and quaint, but it needs a shot in the arm to maintain interest until the big eleven o'clock number.

–DAVID MURPHY

VERDICT 6

Foul Play

+ LES MISÉRABLES (STAGE) Lovely visuals; funky and unique audience mechanic; fun co-op; challenges and unlockables add replay value.

− LES MISÉRABLES (MOVIE) Fighting moves feel underdeveloped; story could benefit from voice-over narration; not very difficult; combo system could be more forgiving.

$15, http://mediatonicgames.com/games/foul-play, ESRB: E

LAB NOTES

JOSH NOREM **SENIOR EDITOR**



GPU Wars Go Thermonuclear

Once more into the breach, dear friends

THERE'S A FAMOUS line from the movie *Bad Boys 2* where Martin Lawrence says the stuff just got real. That's how I felt this month, sitting between AMD and Nvidia as both companies bombarded us with back-and-forth product announcements, new drivers, new technology, new partnerships, and seemingly new everything. AMD was first out of the block with not only its new Hawaii cards, but massively reduced prices on all its previous GPUs, its Mantle API, its new Gaming Evolved app, 4K stitching software, its new TrueAudio, and more. Nvidia returned fire by demoing its ShadowPlay capturing software, announcing a Twitch.tv partnership, showing off its new G-Sync (page 9) hardware, brandishing an all-new GTX 780 Ti, and showing off a holiday gaming bundle! AMD even had the stones to set up camp across the street from Nvidia's press event to lure editors into its own demo. (Slow circular panning shot on me.) Man, it just got real.





Gordon Mah Ung
Deputy Editor

I'm rethinking my mantra that a quad-core (without Hyper-Threading) Core i5 part or six-core AMD part is the right choice for a rig primarily meant for gaming, after seeing the Battlefield 4 beta crush those parts. I'm waiting on final code, but it seems that a quad-core will soon be the *minimum* for gaming, along with a very good GPU, of course.



Jimmy Thang
Online Managing Editor

In boxing, there's a strategy where you let your opponent wail on you until they drop their guard. Perhaps AMD has similarly been playing the long game against Nvidia. AMD's new Mantle API, which should leverage the company's foothold in the consoles, is the counter punch the red team needs. Regardless of how it goes, it's good to see AMD back in the fight.



Richard Koscher
Art Director

I am gearing up for my first half marathon in a long time. I have been trying out all kinds of fitness apps, and although people I talk to prefer Strava, I have to say that I like Runkeeper. It updates me regularly on my mileage and pace as well playing my favorite music. Now, all that's left is to beat Jimmy Thang's time.



Tom McNamara
Associate Editor

I'm used to seeing AMD and Nvidia one-up each other with better cards and pricing every few months. But with AMD's Mantle thing and Nvidia's G-Sync, I haven't seen this level of intensity and wizardry since the dawn of 3D gaming, when 3dfx was slinging Glide. To me, this is just more evidence that high-end computing is doing fine, despite mobile being cheap and ubiquitous.

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Missing: DVD Burner
> CPUs and VMs
> PCIe Bottleneck

Phasing Out Lasers

Did I miss something? None of the three builds in your "Battle of the Budget Builds" (June 2013 issue) made any mention of any type of DVD burner. Only one of the three builds even has one installed. A DVD burner is not mentioned in any of the parts lists.

Please explain, as to many of us, this component is still an important part of a build.

Thanks for helping to clear this up.

—R.T.

ASSOCIATE EDITOR TOM MCNAMARA RESPONDS: Unfortunately, we only had about $650 to work with, after paying about $100 for a Windows license, which made things pretty tight if we wanted to include discrete graphics, overclocking, and a reasonable level of build quality across the whole of the system. This meant leaving some items out, such as RAM capacity and optical drives. On the bright side, USB sticks, portable media players, and external hard drives have mostly replaced the functions of a blank DVD.

You're Not Working Those Chips Hard Enough

I'm a long-time subscriber and avid reader. I especially like any benchmarking or hardware comparison articles, like the October 2013 issue's CPU and Hyper-Threading comparisons ("Put It to the Test"). But there's one serious flaw: You quote 18 different benchmarks that help desktop users and gamers. But a nagging question for many of us is which CPU would serve best as a VMware or Virtual Box server. Would the Core i5-4670 with four cores really compete with an FX-8350 running, say, two virtual machines each with four virtual CPUs?

My suggestion is to create and quote a new benchmark. Install VMware Player 6.0 and run two VMs, each with half the total thread count, run the same 18 benchmarks, and provide the average of the two. Then I could see whether an FX-8350 with eight cores beats, say, a Core i7-3770K with its four cores plus Hyper-Threading, and whether a Core i5-4670K with just four cores is really an option.

My guess and belief is that for this type of workload, you might well see radically different, if not opposite, results.

—Bert Scalzo

DEPUTY EDITOR GORDON MAH UNG RESPONDS: When you're talking about heavily threaded loads, the FX-8350 represents better than it does under gaming or lighter loads, but don't assume that the eight-core will always win. We have indeed seen the FX-8350 ace the Core i5 in heavily multithreaded workloads, but in some tasks it'll still get pummeled by the plain-Jane Core i5 part—and that's Ivy Bridge we're talking about.

The truth can probably be seen in the pricing. If the FX-8350 could hands-down defeat a Core i5-4670K or the Core i7-4770K, you'd see the price of the parts far closer than they are. Honestly, if you're really pushing that many VMs for development work, you're probably a perfect candidate for LGA2011 and a Core i7-4930K. With its six cores and Hyper-Threading, you'll get the best performance overall under such a setup.

Dual Everything

In regard to Dream Machine 2013, if you had used a Xeon processor and had actual dual processors (if they even still make mobos for that) and Nvidia Quadro graphics cards, would you get better gaming performance, or are those specifically designed for business stuff?

—Brian Lewis

SENIOR BUSINESS STUFF EDITOR JOSH NOREM REPLIES: It's a good question, Brian, and the answer is no, we would not have gotten better gaming performance. Most games can't even use all the threads or cores that are available on a single CPU, much less dual CPUs, so games would not benefit from two processors. Plus, Xeons cannot be overclocked at all, so we would have actually lost performance when compared to our 5GHz Sandy Bridge-E processor. On the GPU front, those Quadros are designed for compute duty, not gaming—not to mention costing a premium—so it would have been an expensive path to getting the same or worse performance in our benchmarks.

↘ submit your questions to: comments@maximumpc.com

Dude, Where's My PCIe?

This is in reference to Michael Schwobe's "Four GPUs for One Monitor?" question in the November 2013 Comments section. Josh Norem mentions in passing that "... this is on a Haswell board, so the PCIe bandwidth is likely bottle-necked." Why would that be? I would understand if it was in reference to dual memory channels vs. quad memory channels, but that's not PCIe. Eh?

—C. Steinway

SENIOR EDITOR JOSH NOREM RESPONDS: Z87 Haswell chipsets have half the PCIe 3.0 lanes compared to X79 boards, so, in general, if you are running one or two GPUs you'll be fine with Haswell, but for configs with three or four cards you will want to run an X79 board. On Haswell, if you run one GPU you get full x16 PCIe bandwidth. If you run two cards, you get x8 on each slot. But as soon as you add a third card you will be forced to run it at PCIe 2.0 x4, which runs off a separate PCH chip, so obviously that is not ideal.

> WE HAVE SEEN THE FX-8350 ACE THE CORE I5 IN HEAVILY MULTITHREADED WORKLOADS

ioSafe: The Easy Option

In regard to your ioSafe N2 review in the November 2013 issue, you stated that, "To recover data from the ioSafe N2 with a PC, we needed to boot into Ubuntu (from a Live USB key) and follow a tutorial from the Synology FAQ."

In the real world, customers wouldn't need to do this. The data recovery service allows them to return the toasted—or flooded or whatever—unit to us for data recovery. We'll then return the data to them on replacement drives—we don't recommend that disaster-exposed drives continue to be used—in a replacement N2. All costs covered, including shipping in both directions.

—Brett Callow, ioSafe

A Cubit Won't Buy You Squat

In the Gigabyte GA-Z87X-UD5H review (November 2013) you use the word "cubit" as if it were a monetary unit. Not so; you probably meant shekel. Try Genesis 6:15 to find out what a cubit is.

—Terry Fowler

EDITOR-IN-CHIEF KATHERINE STEVENSON RESPONDS: Thanks for the correction, Terry. We now know that a cubit was the primary unit of measure in the Old Testament and that Noah's ark measured 300 of these in length.

[NOW ONLINE]

AMD TRUEAUDIO Q & A

With TrueAudio, AMD is hoping to do to audio what programmable shaders did for graphics. We've heard it firsthand and can say it does a fantastic job of creating a sense of positional awareness in a virtual environment. How does AMD accomplish this on the GPU? What gear will you need to take advantage of TrueAudio? We get all these questions and more answered online. http://bit.ly/AMDaudio



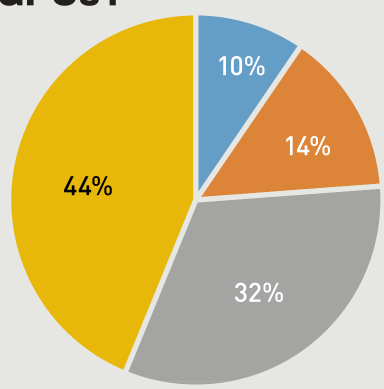
Facebook Polls

What Sites Do Our Readers Surf When They're Bored?

This month we presented you with our favorite sites to check out when we've got some down time, so we asked our Facebook fans for their top sites, as well.

Kenneth Linstrom: Instructables.com
Abraham Carson: Zombo.com
Jim Perry: Usvsth3m.com for interesting tidbits.
Rima Abraham: Lifehacker.com
David Avery: Newegg.com
Pa-ul Ruppert: Threatpost.com
Preston Boyd: Pcpartpicker.com
Naufil Mansury: Thisiswhyimbroke.com
Austin Hsu: Askvg.com
Travis Tatro: Codeacademy.com
Aaron Zook: Mentalfloss.com
Firefox Bancroft: Weknowmemes.com
Juan Carlos Trujillo: Peopleofwalmart.com
Brandon Barrows: Lol Internet—I game when I'm bored!
Drabber Joins: Anyone who says "not porn" is lying.

Are You Upgrading to AMD's R200 Series GPUs?



- Yes, the R9 290X
- Yep, the 280/270/260X
- Waiting for benches
- Nope, will buy Nvidia if price drops

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THE BUILDS

BASELINE



INGREDIENTS

PART		PRICE
Case	Fractal Design Define R4 **NEW**	$80
PSU	Seasonic 650W SS-650KM **NEW**	$70
Mobo	Gigabyte GA-Z87-UD3H	$145
CPU	Intel Core i5-4670K	$230
Cooler	Cooler Master Hyper 212 Evo	$34
GPU	Sapphire Radeon HD 7950 100352-3L	$179
RAM	2x 4GB G.Skill Ripjaws DDR3/1600 F3-12800CL9D-8GBRL	$72
Optical Drive	LG GH24NS95 **NEW**	$15
SSD	Intel 335 Series 240GB	$169
HDD	Seagate Barracuda 1TB	$65
OS	Windows 8 64-bit OEM	$90

Approximate Price: $1,149

WE'RE UPGRADING a few core items this month, but the total cost didn't rise that much, because prices have gone down elsewhere. The biggest change is the case, which used to be a Corsair Carbide 200R but is now the Fractal Design Define R4. Now that this sweet chassis costs just 80 bucks, it's hard to resist. It has two excellent low-noise 140mm fans hooked to a fan controller, pre-installed sound-absorbing panels, removable and even rotate-able drive cages, and generally high build quality for the money. We also upgraded the power supply from a Corsair CX500M to a 650-watt Seasonic X-Series. The new PSU has premium build quality, near-silent operation, and four PCIe connectors instead of the Corsair's two. It ordinarily costs well over $100, so we couldn't pass it up at $70.

PERFORMANCE



INGREDIENTS

PART		PRICE
Case	NZXT Phantom 530	$130
PSU	XFX 850w P1-850B-BEFX	$100
Mobo	Asus Sabertooth X79	$310
CPU	Intel Core i7-4820K	$310
Cooler	Corsair H80i	$85
GPU	EVGA GeForce GTX 780 ACX	$660
RAM	4x 4GB Corsair Vengeance DDR3/1600	$150
Optical Drive	Asus BW-12B1ST	$60
SSD	Samsung 840 Evo 500GB	$340
HDD	Seagate Barracuda 3TB	$135
OS	Windows 8 64-bit OEM	$90

Approximate Price: $2,370

FOR THE FIRST time in many months, we're not changing any hardware at this tier. We considered AMD's new Radeon R9 290X video card, but at press time it was still about a week away from release, and we hadn't seen anything other than the reference design floating around. We'd like to see some vendor-customized cooling with enhanced thermal and acoustic performance before we can recommend one over the EVGA GeForce GTX 780 with its "ACX" cooler, which has roughly the same gaming performance and runs totally cool and quiet. We did see some price dips on the power supply, motherboard, CPU, and SSD, which offset the steadily rising cost of RAM. We selected a four-piece kit because Intel's X79 motherboard chipset works best in a "quad-channel" memory setup.



ULTRA

THIS MONTH, we finally upgraded the Asus P9X79 Deluxe motherboard with the new-and-improved X79 Deluxe. The new board has a host of improvements, and first up is that it has double the SATA 6Gb/s ports, at eight total. Second, it has improved Audio from Realtek by going from ALC898 to ALC1150, and Wi-Fi has also been boosted from 802.11n to 802.11ac. Possibly the most important reason, though, is that the Bluetooth was upgraded from 3.0 to 4.0 (that was a joke). Also, since this mobo only recognizes Intel's new Ivy Bridge-E CPUs out-of-the-box, we upgraded from Sandy Bridge-E to Ivy Bridge-E, as well.

We also upgraded the storage subsystem this month, so both our SSD and HDD got a refresh. First, we decided to give our Ultra build a terabyte drive. We know the Samsung 840 Evo is not as fast as the 840 Pro, but the Pro was not available in a 1TB size when we went to press. It also seemed time to upgrade our HDD from a 3TB Seagate Barracuda to a 4GB unit, now that 4TB drives are actually affordable.

For more of our component recommendations, visit www.maximumpc.com/best-of-the-best.

INGREDIENTS

PART			PRICE
Case	Corsair Obsidian 900D		$300
PSU	XFX ProSeries 1,250W P1-1250-BEFX		$210
Mobo	Asus X79 Deluxe	NEW	$350
CPU	Intel Core i7-4930K	NEW	$580
Cooler	Corsair H100i		$95
GPU	2x EVGA Nvidia GeForce GTX 780 SC ACX		$1,320
RAM	4x 4GB Corsair Vengeance DDR3/1600		$160
Optical Drive	Asus BC-12B1ST BD-R burner		$60
SSD	Samsung 840 Evo 1TB	NEW	$600
HDD	Seagate 4TB Desktop HDD	NEW	$170
OS	Windows 8 Professional 64-bit		$130

Approximate Price: $3,975

UPGRADE OF THE MONTH
CORSAIR VENGEANCE K95



Compared to standard "membrane" keyboards, the mechanical ones require much less effort and tend to be more durable. The Corsair K95 is a great example of the kind of plank you want on your desktop: even backlighting, plenty of macro keys, a snazzy aluminum body, and a large, sturdy wrist rest.

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